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COMMONWEALTH OF MASSACHUSETTS SUMMARY OF WATER QUALITY 1986

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Massachusetts Department of Environmental Quality Engineering
S. Russell Sylva, Commissioner

DIVISION of WATER POLLUTION CONTROL

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COMMONWEALTH OF MASSACHUSETTS

SUMMARY OF WATER QUALITY

1986

Massachusetts Department of Environmental Quality Engineering
Division of Water Pollution Control
Technical Services Branch

Westborough, Massachusetts
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EXECUTIVE SUMMARY

The Massachusetts Department of Environmental Quality Engineering (DEQE) has many divisions involved in the sampling, studies, preservation and clean-up of the surface and groundwaters of the Commonwealth. Each division operates under their regulations and management programs to protect and improve the water quality.

Surface Water Quality

The surface water quality in Massachusetts has improved considerably since the 1972 Federal Water Pollution Control Amendments were enacted. Of the 10,704 river miles in Massachusetts, 1675.5 major miles have been surveyed. These represent the significant, major rivers located throughout the Commonwealth. The other rivers are small streams which can be assumed to be achieving desired water quality. It is impossible to collect data from all streams in the state. Eight hundred two or 48% of these river miles fully support their designated use. This is a significant improvement over the water quality of 1972.

	1972	1986
Classification Supported	27.5%	48%
Partially Supported	27.5%	34%
Classification Not Supported	45%	18%

Ninety-two percent of the lakes and ponds acreage assessed meet oligotrophic or mesotrophic status and 25% of the harbors and bays fully meet their water quality classification with 66% partially supporting their classification.

Analysis of Massachusetts water quality attributes partially supporting and non-supporting status of the rivers designated classification to municipal sources (26%), nonpoint sources (24%), combined sewer overflows (16%) natural conditions (14%) in place sediments (7%), industrial sources (6%) and other sources (7%). The major measures of pollutants in the rivers and harbors are bacteria/pathogens, dissolved oxygen, biochemical oxygen demand, and nutrients.

PCB and heavy metal contamination severely impact a few basins and harbors, resulting in fish consumption advisories and toxic aquatic conditions. New Bedford Harbor and the Housatonic River have fish advisories due to PCB levels. Boston Harbor flounder had the highest prevalence of liver lesions and tumors of the harbors and coastal areas sampled. Eight percent of the fish from Boston Harbor had cancer of the bile duct and/or liver, 42 percent had lesions (unknown pathology), 44 percent had fin rot. Lobsters from Boston Harbor and New Bedford Harbor and the Acushnet River had the highest percentage of shell disease and black gill disease. These diseases are caused by high levels of pollution.

Shellfish contamination has been increasing rapidly, primarily due to domestic sewage and high coliform bacteria pollution. Many of the North Shore shellfish flats have been closed since the early thirties, but the shellfish around the Cape and Buzzards Bay have recently become affected (1980). A total of 24,780 acres (38.7 square miles) of productive and non-productive shellfish areas have been closed in Boston and the North Shore. The southeast region of Massachusetts has an additional 25,398 acres (39.7 mi^2) of shellfishing flats closed. The increase in shellfish closures due to bacterial contamination has been found through more monitoring and reclassification. It appears that coastal water contamination is more widespread than realized and special actions and programs are now being initiated by the Department.

Surface Water Programs

The NPDES and Construction Grants programs have been responsible for the reduction of BOD, bacteria and solids problems in the rivers. A continuation of these programs will further upgrade river water quality. The value of proper operation and maintenance of existing sewage treatment plant facilities is recognized and is administered through a new Technical Assistance Section of the Department of Environmental Quality Engineering (DEQE).

The present focus of the Division of Water Pollution Control (DWPC) is on the complex problems of combined sewer overflows, toxic contamination and eutrophication. These problems are difficult to assess and expensive to correct. The likelihood of successful abatement projects being funded decreases as federal support is reduced.

Pollution of coastal waters due to ocean discharges, urban runoff and combined sewer overflows have recently been studied. Efforts are being made by the Division of Water Pollution Control to establish a coastal monitoring section to study and monitor the harbors and bays.

The Massachusetts Water Resource Authority (MWRA) was established in 1984 to help solve the complex pollution problem of Boston Harbor, in part, through renovation and upgrading of the sewer systems and operation and management of combined sewer overflows. The MWRA has the monumental task of regulating an estimated 5,200 industrial users discharging into the municipal sewer system.

New Bedford Harbor PCB contamination, a confirmed hazardous waste site on the superfund list, has been studied intensively. Recently five dredging alternatives were recommended for removal of the PCB laden sediments in the Acushnet River and New Bedford Harbor. The recommendations are currently under review by EPA.

Groundwater Quality

Groundwater contamination is becoming apparent due to the increasing number of groundwater public water supplies being closed. Forty-six communities have had to close part or their entire public water supplies due to contamination; 45 of these closures involved groundwater. The sources of the water supply contamination are due to industrial activities, accidental spills, road-salting, landfills, over development and pesticides. Organic chemicals have caused the contamination in 67% of the state's closures.

Groundwater Programs

Programs are being established to protect the groundwater in the Commonwealth. Chapter 286 of the acts of 1982 gives the DEQE money and authority to prevent and clean up contaminated public water supplies. Protection of the Commonwealth's groundwater resources is further provided through resource information maps, land acquisition and a groundwater discharge permit program. In the discharge permit program the groundwaters were classified with respect to their most sensitive use. Class I is for fresh water designated a potable water supply, Class II is for saline waters converted to fresh potable water or manufacturing and Class III is for groundwater not designated potable water. Each discharge permit is reviewed on a case-by-case basis and strict discharge limits and monitoring requirements must be met.

Special Concerns

Water quality in Massachusetts has been improving, yet many rivers, lakes, harbors and groundwater supplies continue to remain in violation of their designated standards. The Department is addressing the following special concerns to further upgrade the Commonwealth's waters:

1. Wide-spread contamination of water supply systems.
2. Proper containment of hazardous waste sites.
3. Coastal water quality degradation.
4. Prevention and control of non-point sources.
5. Eutrophication of lakes and ponds.
6. Acidification of lakes and ponds
7. Proper operation and maintenance of water and wastewater treatment plants.
8. Evaluation of chronic toxicity and bioaccumulation.

By establishing a Coastal Monitoring Section, Technical Assistance and Training Section, Nonpoint Source Pollution Control Program and increasing the number of personnel and projects in the Division of Solid and Hazardous Waste and Clean Lakes programs the special concerns will be covered. Inadequate funding is the major limiting factor in all concerns and programs established.

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INTRODUCTION

The waters of the Commonwealth of Massachusetts have been subjected to degradation from various sources such as domestic sewage, industrial chemicals, urban runoff, and atmospheric deposition. Water quality problems were amplified as population increased and industrial development intensified. Often untreated or poorly treated wastewater was disposed into the nearest waterbody with little regard for the quality of the receiving water. The problems associated with wastewater disposal and stormwater runoff have been recognized for decades by members of the scientific community and to varying degrees by the general populace. Stern and expensive measures were necessary to retard and eliminate the degradation of the waters of the Commonwealth. The vehicle to re-establish the quality of the water resources was provided by the landmark legislation passed by Congress in 1972 - the amendments to the Federal Water Pollution Control Act, Public Law 92-500. This act set forth goals and a policy for the attainment of desired water quality across the nation. Most importantly, the act provided funds necessary to finance the vast water pollution abatement projects necessary to achieve and maintain water quality goals.

Section 305(b) of the Clean Water Act requires each State to submit a biennial report to the EPA describing the quality of its navigable waters. This report is to include the following: an analysis of the extent to which the State's waters provide for healthy shellfish, fish, and wildlife populations and recreation in and on the water; an analysis of the extent to which pollution control actions have achieved this level of water quality and recommendations for needed additional actions; an estimate of the environmental impacts, economic and social costs and benefits and date of achieving this level of water quality; and a description of the nature and extent of nonpoint sources of pollution and recommendations for their control.

BACKGROUND

The geology of Massachusetts is divided into two provinces; the Coastal Plain and the New England Upland. Cape Cod and the islands form the coastal plain and consist of low hills and plains covering unconsolidated sediments which forms the most productive aquifers in the State. The New England Upland province consists of till and stratified drift above metamorphic and igneous rocks, provides small productive aquifers.

The Commonwealth of Massachusetts has the largest population of the six New England States by over 2½ million people, with the majority of the population in the eastern portion. There are a significant number of freshwater, coastal and groundwater resources used by the people for recreation, beauty and drinking water. These sources are monitored and regulated by the Department of Environmental Quality Engineering. Of a total surface area of 8257 square miles, 5 percent or 460 square miles is water surface. Table 1 below presents a summary of surface waters.

TABLE 1

MASSACHUSETTS ATLAS

State Population (1985)	5,750,101
Total Surface Area (mi^2)	8,257
Number of Drainage Basins	32
Number of Interstate Basins	12
Total River Miles	10,704
Number of Lakes and Ponds	2,859
Area of lakes and Ponds (acres)	150,341
Area of Marsh and Wetland (acres)	362,165
Area of Harbors (mi^2)	164
Total Coastal Miles	1,519

The aquatic life and public health concerns of these water resources are described in detail in the body of this report.

Figure 1 DRAINAGE SYSTEMS

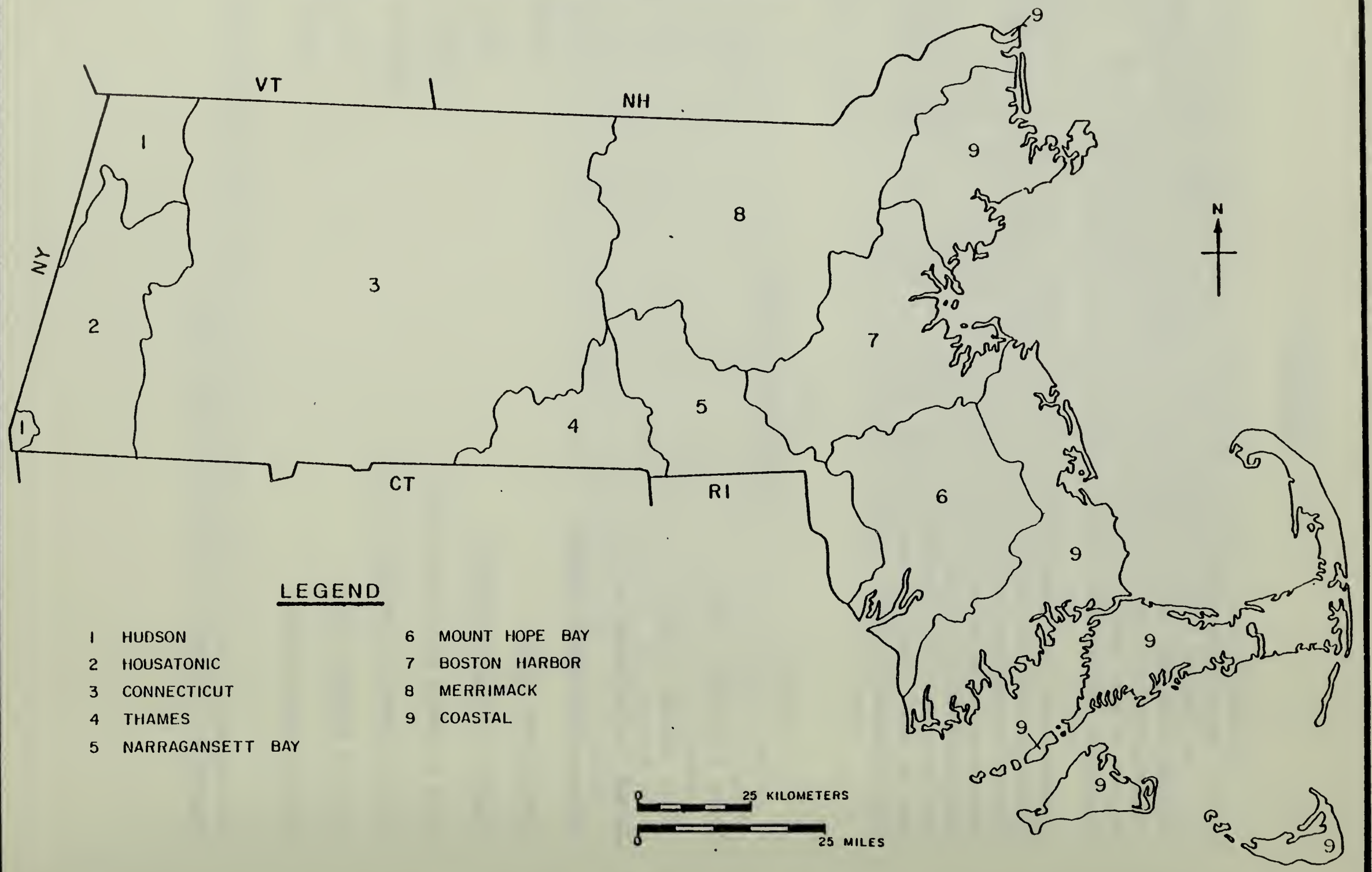
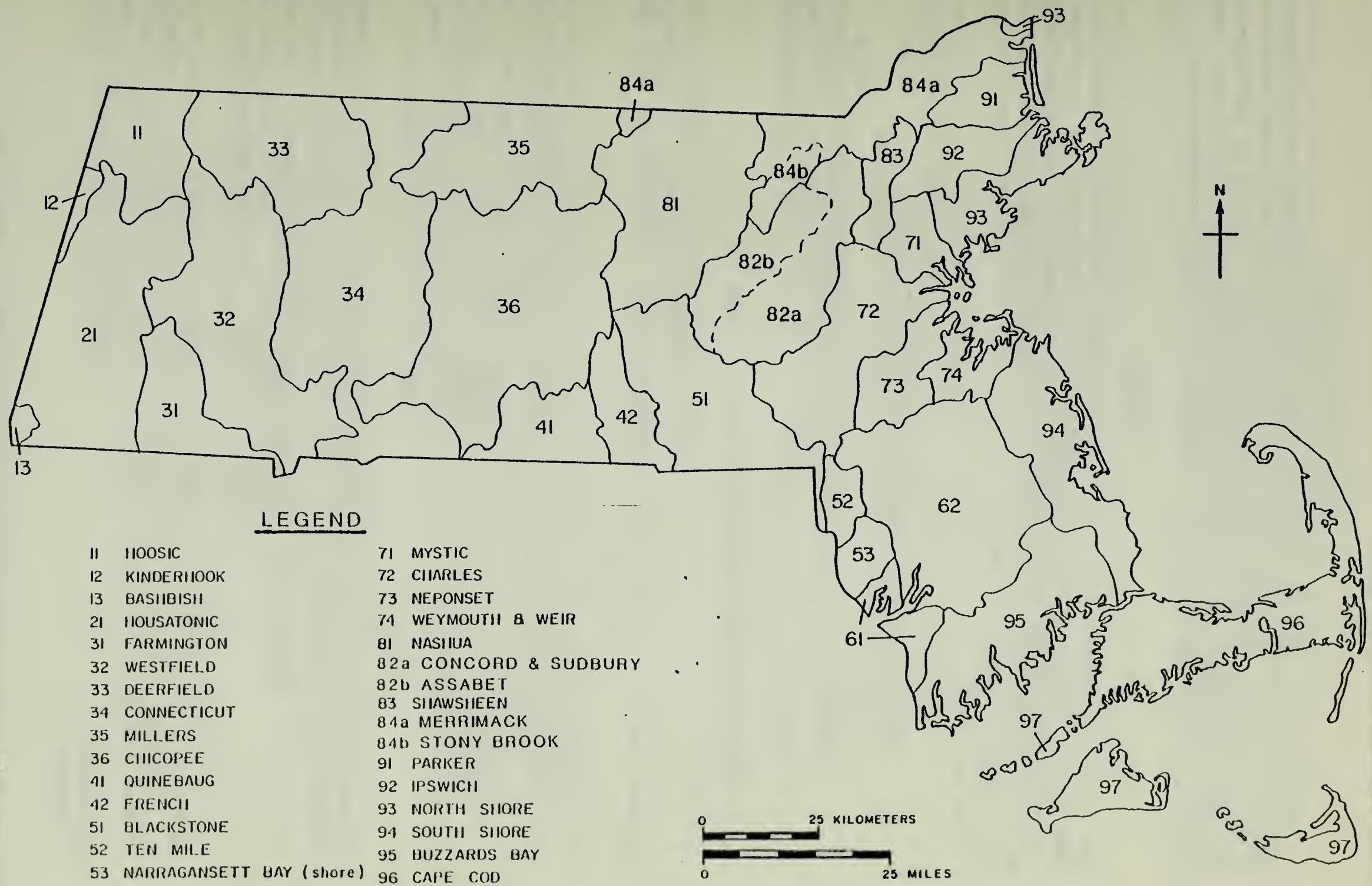


Figure 2 RIVER BASINS and COASTAL DRAINAGE AREAS



LEGEND

11 HOOSIC	71 MYSTIC
12 KINDERHOOK	72 CHARLES
13 BASHBISH	73 NEPONSET
21 HOUSATONIC	74 WEYMOUTH & WEIR
31 FARMINGTON	81 NASHUA
32 WESTFIELD	82a CONCORD & SUDBURY
33 DEERFIELD	82b ASSABET
34 CONNECTICUT	83 SHAWSHEEN
35 MILLERS	84a MERRIMACK
36 CHICOPEE	84b STONY BROOK
41 QUINEBAUG	91 PARKER
42 FRENCH	92 IPSWICH
51 BLACKSTONE	93 NORTH SHORE
52 TEN MILE	94 SOUTH SHORE
53 NARRAGANSETT BAY (shore)	95 BUZZARDS BAY
61 MOUNT HOPE BAY (shore)	96 CAPE COD
62 TAUNTON	97 ISLANDS

SURFACE WATER QUALITY

Analysis of those surface waters for which monitoring data are available is summarized below. Data are available for 1675.5 of 10,704 river miles (15.6%), 46,299 of 150,341 acres of lakes and ponds (30.8%), and 155 of 164 square miles of harbors (94.8%). These data are presented in a semi-tabular form. The designated uses and water quality standards can be found in Appendix I.

Status

Due to time and money constraints not all waters are surveyed every year. The data below, however, reflect the most up-to-date monitoring and knowledge of the conditions of the surface waters in the Commonwealth. Miles assessed are those miles where water quality sampling, fish/shellfish sampling, and biological assessments have been made.

Rivers

Number of miles supporting the designated use(s)	802.1
Numbers of miles partially supporting the designated use(s)	571.8
Number of miles not supporting the designated use(s)	301.6
Total river miles assessed	1675.5

For fishable/swimmable status see section on page 17.

Lakes & Ponds

Current Status: 462 lakes with baseline surveys. All lakes are less than 1500 acres.

Trophic Status of Surveyed Lakes	Acres	# of Lakes
Eutrophic	3922	62
Mesotrophic	26688	276
Oligotrophic	15689	124
Totals:	46299	462

Unknown Acres = 150,341 - 46299 = 104,042
Lakes/Ponds Not Surveyed 2859 - 462 = 2397

Status of Ch. 628 Clean Lakes Program* (# Lakes)

FY	83	84	85	86 (potential)
Phase I	23	23	13	28
Phase II	6	6	6	23
Maintenance Projects	2	7	4	6

* Many of these projects are in various stages of completion.

A Phase I project is a diagnostic/feasibility study of a lake or pond which identifies existing and potential pollution problems and recommends cost-effective and feasible solutions.

A Phase II project is the implementation of the Phase I recommendations for long-term restoration and preservation of the lake/pond and its watershed.

Water Quality Maintenance Projects are short-term remedies for nuisance aquatic vegetation and algal problems.

The DWPC Lakes Section classifies lakes/ponds by trophic status but not by use. Therefore, designated uses does not apply to the Commonwealth's Lakes and Ponds Classification System.

An outline of the lakes classification program and the methodology employed in determining trophic state is found in Appendix II (p. A-II-1).

Bays & Harbors

Square Miles Supporting Designated Use(s)	39
Square Miles Partially Supporting Designated Use(s)	105
Square Miles Not Supporting Designated Use(s)	12
Total Square Miles	156

Fishable/swimmable has not been classified due to difficulty in definition. See page 17 for studies conducted.

Wetlands

The Division of Wetlands is responsible for enforcing the provisions of the Wetland Protection Act and acting as the appeal agency to local conservation commissions. The provisions of the Wetland Protection Act protect the public interest by regulating fisheries, groundwater, land containing shellfish, flood control, prevention of pollution, storm damage prevention and groundwater used as drinking water. The jurisdiction of the Act, however, is limited to land subject to flooding (100 year flood plain) and to land within 100 feet of a wetland.

Updated regulations to the Wetland Protection Act (310 CMR 10.00) were promulgated on April 1, 1983 and established stringent limitations on the filling of wetlands. In summary, filling is prohibited unless four conditions are met: (a) the wetland is isolated; (b) the volume of water is less than ¼ acre-feet; (c) the bottom is impermeable; and (d) the filling does not displace water onto neignboring property.

Unfortunately, the number of acres of wetlands lost is not readily available. It is known that the number of orders to proceed in 1983 (3300) is about equal to the total number of orders given in the previous five years. This increase in activity was probably due to the desire to get approval under the old regulations.

TABLE 2
BASIN WATER QUALITY SUMMARY

	Miles Assessed	Miles Meeting Standards	Miles Partially Meeting Standards	% Meeting Standards	% Partially Meeting Standards
Assabet River Basin (82)	31.0	0	1.0	0	3.2
Blackstone River Basin (51)	84.9	36.0	17.2	42.4	20.3
Δ Boston Harbor Basin (70)	46.31	2.18	40.87	4.7	88.3
* Buzzards Bay Basin (95)	85.7/ 11.93	68.2/0.78	12.0/4.99	79.6/6.5	14.0/41.8
* Cape Cod Basin (96)	6/31.05	6/0	0/31.05	100/0	0/100
Charles River Basin (72)	90.7	62.0	4.1	68.4	4.5
Chicopee River Basin (36)	134.5	85.1	43.1	63.3	32.0
Connecticut River Basin (34)	79.9	57.7	22.2	72.2	27.8
Deerfield River Basin (33)	79.2	76.8	0.5	97.0	0.6
Farmington River Basin (31)	25.6	25.6	0	100	0
French River Basin (42)	35.5	21.2	4.0	59.7	11.3
Hoosic River Basin (11)	37.9	3.8	32.3	10.0	85.2
Housatonic River Basin (21)	84.2	17.1	56.8	20.3	67.5
Ipswich River Basin (92)	36.6	32.1	4.5	87.7	12.3
Δ Islands Basin (97)	21.57	21.57	0	100	0
Merrimack River Basin (84)	72.8	15.6	34.2	21.4	47.0
Millers River Basin (35)	51.0	28.5	22.5	55.9	44.1
Mount Hope Bay Drainage Basin (61)	7.2	0	1.8	0	25.0
Mystic River Basin (71)	23.9	0	0	0	0
Nashua River Basin (81)	101.9	25.3	62.6	24.8	61.4

TABLE 2 (CONTINUED)

	Miles Assessed	Miles Meeting Standards	Miles Partially Meeting Standards	% Meeting Standards	% Partially Meeting Standards
Neponset River Basin (73)	32.6	0	24.7	0	75.8
* North Coastal Drainage Basin (93)	43.0/ 27.44	1.9/0.56	8.6/24.64	4.4/2.0	20.0/89.8
Parker River Basin (91)	22.0	22.0	0	100	0
Quinebaug River Basin (41)	38.1	30.0	2.0	78.7	5.3
Shawsheen River Basin (83)	25.0	0	25.0	0	100.0
* South Shore Drainage Basin (94)	43.3/ 17.21	0.0/13.46	43.3/3.75	0/78.2	100/21.8
Stony Brook Basin (84)	22.0	0	15.6	0	70.9
Sudbury and Concord River Basins (82)	57.8	35.0	6.1	60.6	10.6
Taunton River Basin (62)	171.9	56.0	84.6	32.6	49.2
Ten Mile River Basin (52)	31.6	10.9	11.9	34.5	37.7
Westfield River Basin (32)	106.0	84.0	22.0	79.3	20.7
Weymouth and Weir River Basins (74)	13.7	1.3	9.2	9.5	67.2
Totals	1675.5/ 155.51	802.1/ 38.55	571.8/ 105.3	47.9/ 24.8	34.1/ 67.7

* River miles/embayment area
Embayment area only (mi^2)

Changes in Water Quality

Since 1984 the water quality in Massachusetts has not changed considerably. An additional 41 river miles was sampled, enlarging the data base. Wastewater treatment plant upgradings, sewer tie-ins and pretreatment are all actively occurring. The majority of these projects are currently in the planning and construction phases. Significant improvements in water quality are expected with completions. The impact of some of the completed projects have not yet been measured and extensive surveys are planned for next year (see Appendix II for water quality trend by basin).

Causes of Nonsupport of Designated Uses

River and harbor data were reviewed for causes of nonsupport of designated uses since not all waters are meeting their designated use classification. Each basin has different problems and sources causing the non-support. Each basin was evaluated separately into percent of contaminant contribution from each source. The major pollutants in each basin were further ranked as to the leading responsibility for the poor water quality.

Table 3 shows a breakdown by basin into percentages of sources causing partial support or non-support of the classification in each river basin. The various causes of non-support are: marinas and boats, industrial sources, municipal sources, combined sewer overflows, non-point sources and urban runoff, natural conditions, agriculture, in-place sediments and unknown causes. When the percent of waters affected by these causes are compared, municipal sources appear to account for 26.2% of the problems. Next is nonpoint sources and urban runoff with 23.7%, combined sewer overflows with 16.3%, natural conditions with 13.5% and the fifth highest contributing factor is in-place sediments with 7.1% (see Table 3 below).

Although municipal sources cause the greatest percentage of the nonsupport in the basins, non-point sources and urban runoff affect more basins. Twenty-six of the 33 basins listed non-point source as a cause for the non-support compared to 25 basins listing municipal sources, 16 basins listing combined sewer overflows and natural conditions, and 15 basins listing in-place sediments.

Municipal sources and combined sewer overflows can be corrected to improve the water quality by constructing new or improved wastewater treatment plants, sewer tie-ins, better management practices at the existing upgraded plants and tne implementation of pretreatment. Urban runoff and non-point source control is more difficult to implement. Storm drain catch basins with oil/grease separators, and street drain cleanings can help eliminate some problems with urban runoff. New regulations for landfill design and maintenance will also help non-point source control.

Assessment of Major Parameters of Concern

The major pollutants responsible for the water quality degradation in each basin were ranked from leading cause to least cause (see Table 4). Some basins have only one pollutant listed as causing the degradation while others list up to seven pollutants. The most common pollutant being listed in 30 the of 32

basins was bacteria and other pathogens. This was listed as the leading cause of degradation in 21 of the 30 basins. The second leading problem was low D.O. and high BOD followed by nutrients. The remaining pollutant groups are scattered throughout the basins. Heavy metals and oil and grease tend to be problems in the coastal waters while PCB's dominate the Hoosic River Basin and Housatonic River Basin in the western part of the State.

Municipal sources and combined sewer overflows, which account for 42.5 percent of the problems, are the leading contributor of the bacteria and other pathogens causing the rivers not to meet their classifications. Natural phenomena will cause dissolved oxygen violations, but these are inherent in wetland areas and can not be corrected. Nutrients often cause algal blooms and thus large diurnal dissolved oxygen swings. Nutrients are contributed mainly through the municipal sources, CSO's, non-point sources and agricultural activities. Contaminated sediments and industrial sources are the major contributors of heavy metals and PCB's. Pretreatment actions and stricter NPDES limits are correcting these problems.

TABLE 3

PERCENT CAUSE OF NONSUPPORT OF DESIGNATED USES

	Marinas/ Boats	Industrial Sources	Municipal Sources	Combined Sewer Overflows	Non-point Sources**	Natural Conditions	Agri-culture	In-place Sediments	Other	Unknown
Assabet River Basin	--	--	70	--	15	--	--	15	--	--
Blackstone River Basin	--	17	18	--	55	--	--	10	--	--
Boston Harbor Basin	--	--	58	28	--	--	--	14	--	--
Buzzards Bay Basin	--	15	25	10	20	10	5	15	--	--
Cape Cod Basin	25	--	--	--	50	10	10	5	--	--
Charles River Basin	--	--	29	27	27	5	--	12	--	--
Chicopee River Basin	--	--	10	15	30	25	20	--	--	--
Connecticut River Basin	--	--	16	84	--	--	--	--	--	--
Deerfield River Basin	--	--	100	--	--	--	--	--	--	--
Farmington River Basin	--	--	--	--	--	--	--	--	--	--
French River Basin	--	--	80	--	10	--	4	6	--	--
Hoosic River Basin	--	--	50	--	25	--	25	--	--	--
Housatonic River Basin	--	20	10	--	20	--	--	50	--	--
Ipswich River Basin	--	--	--	--	15	75	--	--	--	10
Islands Basin	30	--	10	--	50	5	5	--	--	--
Merrimack River Basin	--	10	30	30	20	--	--	10	--	--
Millers River Basin	--	68	32	--	--	--	--	--	--	--
Mount Hope Bay Drainage Basin	--	--	10	70	20	--	--	--	--	--
Mystic River Basin	--	--	--	56	--	8	--	36	--	--
Nashua River Basin	--	--	10	30	55	5	--	--	--	--

TABLE 3 (CONTINUED)

	Marinas/ Boats	Industrial Sources	Municipal Sources	Combined Sewer Overflows	Non-point Sources**	Natural Conditions	Agri-culture	In-place Sediments	Other	Unknown
Neponset River Basin	--	--	--	37	32	31	--	--	--	--
North Coastal Drainage Basin	4/3	--	0/66	8/26	--	--	--	11/0	--	77/0
Parker River Basin	--	--	--	--	20	80	--	--	--	--
Quinebaug River Basin	--	--	62	--	38	--	--	--	--	--
Shawsheen River Basin	--	5	--	--	40	50	5	--	--	--
South Shore Drainage Basin	--	--	15/22	0/50	48/20	37/0	--	--	--	0/8
Stony Brook Basin	--	30	--	--	20	40	--	10	--	--
Sudbury and Concord River Basins	--	--	20	--	35	35	--	10	--	--
Taunton River Basin	--	10	40	20	5	20	--	5	--	--
Ten Mile River Basin	--	25	25	--	15	10	--	25	--	--
Westfield River Basin	--	--	10	40	50	--	--	--	--	--
Weymouth and Weir River Basin	--	--	46	7	47	--	--	--	--	--

* River mile/embayment area
** Non-point source includes urban runoff

TABLE 4
POLLUTANT RANK BY BASIN*

	Oil & Grease	Bacteria/ Pathogens	Nutrients	Turbidity/ TSS	D.O./ BOD	Salinity/ TDS	pH	Heavy Metals	PCB's	Other Organics	Other
Assabet River Basin	--	2	3	4	1	--	--	--	--	5	--
Blackstone River Basin	--	1	3	4	2	--	5	6	--	--	--
Boston Harbor Basin	4	1	--	--	3	--	--	2	--	--	5 (debris)
Buzzards Bay Basin	3	4	--	5	--	--	2	6	1	7	--
Cape Cod Basin	1	2	--	3	--	4	--	--	--	--	--
Charles River Basin	--	1	3	--	2	4	--	--	--	--	--
Chicopee River Basin	--	1	3	--	2	--	4	--	--	--	--
Connecticut River Basin	--	1	3	--	2	--	--	--	--	--	--
Deerfield River Basin	--	1	2	--	--	--	--	--	--	--	--
Farmington River Basin	--	--	--	--	--	--	--	--	--	--	--
French River Basin	--	1	2	--	3	--	--	--	--	--	--
Hoosic River Basin	--	1	--	2	--	--	--	--	3	--	--
Housatonic River Basin	--	3	4	--	2	--	--	--	1	--	--
Ipswich River Basin	--	2	--	--	1	--	--	--	--	--	--
Islands Basin	--	1	2	5	--	3	--	4	--	--	--
Merrimack River Basin	--	1	3	--	2	--	--	--	--	--	--
Millers River Basin	--	--	1	3	2	--	--	--	--	--	--
Mount Hope Bay Drainage Basin	--	1	2	--	3	--	--	--	--	--	--
Mystic River Basin	3	1	5	--	2	--	--	4	--	--	--
Nashua River Basin	--	1	2	4	3	--	--	--	--	--	--
Neponset River Basin	--	1	3	--	2	--	--	--	--	--	--
North Coastal Drainage Basin	--	1	2	--	3	--	--	--	--	--	--

TABLE 4 (CONTINUED)

	Oil & Grease	Bacteria/ Pathogens	Nutrients	Turbidity/ TSS	D.O./ BOD	Salinity/ TDS	pH	Heavy Metals	PCB's	Other Organics	Other
Parker River Basin	--	1	--	--	2	--	--	--	--	--	--
Quinebaug River Basin	--	1	3	2	--	--	--	--	--	--	--
Shawsheen River Basin	--	2	3	4	1	--	--	--	--	--	--
South Shore Drainage Basin	--	1	3	--	2	--	--	--	--	--	--
Stony Brook Basin	--	2	3	--	1	--	--	--	--	--	--
Sudbury and Concord River Basins	--	2	3	--	1	--	--	4	--	--	--
Taunton River Basin	--	1	3	4	2	5	--	--	--	--	--
Ten Mile River Basin	--	3	2	--	4	--	--	1	--	--	--
Westfield River Basin	--	1	--	--	--	--	--	--	--	--	--
Weymouth and Weir River Basin	--	1	--	--	2	--	--	--	--	--	--

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* Number one (1) indicates leading cause

TABLE 5
SUMMARY OF REASONS FOR NONSUPPORT
POLLUTANT RANK BY POLLUTION SOURCE

	# Basins Listing Source	Frequency By Rank	% of Total	Severity Rank
Marinas/Boats	4		2.0	
Industrial Sources	9		6.1	
Municipal Sources	25	2	26.2	1
Combined Sewer Overflows	16	3	16.3	3
Nonpoint Source/Urban Runoff	26	1	23.7	2
Natural Conditions	16	3	13.5	4
Agriculture	7		2.2	
In-place Sediments	15	5	7.1	5
Unknown	3		2.9	
	121		100%	

TABLE 6
POLLUTANT RANK BY PARAMETER

	# Basins Listing Pollutant	Frequency Rank	% of Total	Severity Rank
Oil & Grease	4		3.9	
Bacteria/Pathogens	30	1	15.3	3
Nutrients	23	3	22.4	1
Turbidity/TSS	11	4	13.5	4
D.O./BOD	24	2	17.8	2
Salinity/TDS	4		5.7	
pH	3		3.9	
Heavy Metals	7	5	9.6	5
PCB's	3		1.8	
Other Organics	2		4.3	
Debris	1		1.8	
	112		100.0	

TABLE 7
SOURCE AND POLLUTANT CONTRIBUTORS

	Oil & Grease	Bacteria/ Pathogens	Nutrients	Turbidity/ TSS	D.O./ BOD	Salinity/ TDS	pH	Heavy Metals	PCB's	Other Organics	Other
Marinas/Boats	I	M	--	--	--	--	--	--	--	--	--
Industrial Sources	--	--	I	I	--	--	--	M	--	I	--
Municipal Sources	--	M	M	--	M	--	--	M	--	--	--
Combined Sewer Overflows	M	S	M	M	--	--	--	--	--	--	--
Nonpoint Source/ Runoff	M	M	M	I	--	--	--	--	--	--	--
Natural Conditions	--	--	--	--	M	--	--	--	--	--	--
Agriculture	--	M	M	M	--	--	--	--	--	--	--
In-place Sediments	--	--	--	--	--	--	--	S	S	--	--
Unknown	--	I	I	--	I	--	--	--	--	--	--

Severity - S = Severe (designated use is impaired)
M = Moderate - designated use is not precluded, partial
I = Minor - designated use is almost always supported

FISHABLE/SWIMMABLE STATUS

Fishable/swimmable is defined as "providing a level of water quality consistent with the goal of protection and propagation of a balanced population of shellfish, fish, and wildlife, and allowing for recreational activities in and on the water." It is difficult to provide an analysis of the degree to which the fishable/swimmable goal is met in every stream. If comparison with past 305(b) reports is desired, it is possible to equate those river segments which are designated as "meeting standards" as "swimmable" and those designated as either "meeting standards" or "partially meeting standards" as "fishable."

Fish population sampling carried out by the Massachusetts Division of Fisheries and Wildlife over the last fifty years has consistently shown that waters lower than Class B are incapable of producing viable and healthy populations of fish and wildlife for public recreational use. While it is true that these waters do sustain fish populations, they are characteristically low in species diversity and dominated by species such as carp, suckers, goldfish, and minnows which are of little interest to the recreational fishing public. Sport fisheries for largemouth bass, smallmouth bass, trout, chain pickerel, northern pike, tiger muskie, and yellow perch exist or have been developed in waters designated as Class B or higher.

Presently the Division of Fisheries and Wildlife annually stocks 150 trout ponds and 400 streams totaling 2000 miles across the state. Managed waters must be accessible to the general public for fishing, and be of acceptable water quality, Class B or higher. Natural production of fishes in the state supplements the majority of the fishing and is comprised primarily of warm water fishes. As waters become fishable/swimmable, positive shifts in the fish populations occur.

Improvements in waters of the Commonwealth such as the Connecticut and Merrimack Rivers have enabled the Division of Fisheries and Wildlife, in conjunction with other state and federal resource agencies, to restore runs of American Shad and Atlantic Salmon. These are notable gains offering substantial public recreational sport fishing opportunities.

At specific areas of contamination of toxic pollutants, the Division of Water Pollution Control, Division of Fisheries and Wildlife and Department of Public Health have put warnings or bans on the consumption of fish. There is a warning on the consumption of fish due to elevated PCB levels in the Housatonic River. Fishermen may catch and release the fish for recreation. Hocomonco Pond in the Town of Westborough has a warning posted for fishing due to creosote levels.

In New Bedford Harbor, due to elevated PCB levels in the sediments and water, the catching of fish has been banned. Since 1979 the Acushnet River estuary has been closed to all fishing and shellfish activities.

Studies

Fish, lobster and shellfish studies have been conducted by the Division of Marine Fisheries (DMF) in the coastal waters of Massachusetts. The data were presented in a report titled "Assessment at Mid-Decade" in November 1985. Fish were sampled for liver lesions and tumors, lobsters for shell disease (shell erosion and tissue destruction) and black gill disease (fouling and erosion of gills and destruction of underlying tissue), soft shell clams for a "leukemic" type blood disease and snellfish for bacterial contamination. All of these diseases are due to elevated levels of contaminants in the ocean waters.

Boston Harbor was found to have the highest incidence (3%) of cancer of the bile duct and/or liver in flounder and highest occurrence (10%) of fish fin rot. Black gill disease was prevalent 33 percent of the time, second to New Bedford Harbor.

New Bedford Harbor and the Acushnet River, besides having a fish consumption ban, had the highest incidence of lobster disease and soft shell clam blood disease. Lobster shell disease was found 50 and 33 percent of the time in the Acushnet River and New Bedford Harbor, respectively, and black gill disease was approximately 52%. Furthermore, the soft shell clam blood disease was present in 90% of the shellfish.

Shellfish contamination from fecal coliform bacteria has been increasing at an alarming rate. In 1980, 19,891 acres south of Boston Harbor were closed to the harvest of shellfish. By November 1, 1984 an additional 3,469 acres were closed (25,398 acres total), a 27.7% increase in four years. All of Boston Harbor has been closed to shellfish harvesting except 2,864 acres which occasionally are classified as "restricted." In the North Shore only 40.5% of the productive flats (1,424 acres) are open. Eighteen thousand non-productive acres have been closed due to water quality standard violations. In summary, a total of 24,780 acres (38.7 square miles) of productive and non-productive shellfish areas have been closed in Boston and the North Shore. In the Cape Cod and southeast region, a total of 25,398 acres (39.7 square miles) of productive and non-productive shellfish areas have been closed. A breakdown by basin can be found in Table 8.

TABLE 8
ACRES OF SHELLFISH CLOSURES

BASIN	1984 ACRES CLOSED	1984 ACRES RESTRICTED*	1984 ACRES OPEN
North Shore	810.10	5143	1423.9
Boston Harbor	1826.4	2864.0	0
South Shore	5426.2	—	**
Cape Cod	2102.5	—	**
Islands	616.9	—	**
Buzzards Bay	17245.8	—	**
Total	28793.6	3378.3	

* Restricted areas where depuration is required.
\- No restricted areas
** Acres open are unknown

BASIN/SEGMENT INFORMATION

A summary by drainage basin is found in Table 2. Appendix III contains 32 detailed drainage basin summaries. Each synopsis contains a narrative basin description, a water quality conditions and trends description, a bibliography of up-to-date basin reports, a basin map, and a classification table of water quality segments. These appear in alphabetical order with the basin order shown in Figure 2. Each classification table has seven elements that are defined below.

1. Segment Description: A description of the river segment or harbor.

2. River Miles: Inclusive mile points of the segment, where 0.0 is the mouth of the river, or the area of a harbor in square miles.

3. Water Use Classification: See Appendix I.

4. Support Status: An indication of the segments support (S), partial support (PS), non-support (NS), or unknown (U) of the water classification.

5. Water Quality Problems: Those parameters which cause a segment not to meet its designated use, or natural conditions.

6. Source(s) of Problems: Natural or anthropogenic inputs which cause noncompliance.

7. Abatement Needs to Meet Classification.

GROUNDWATER QUALITY
PUBLIC WATER SUPPLIES

As of 1985, 275 of the 351 cities and towns in Massachusetts rely upon groundwater totally or in part for their drinking water. Seven percent of the population relies upon private water supplies, and 34% of Massachusetts derives its public water supplies solely from groundwater. Forty-six communities in Massachusetts have recently had their entire or a portion of their public water supplies closed due to contamination. Forty-five of the incidents involved groundwater sources and one involved a surface water source. This represents the permanent or temporary loss of 80 public wells or wellfields in Massachusetts and does not include the numerous private wells closed down.

These forty-six communities are located in twenty river basins across the state. Seven of these basins have had three or more occurrences of public water supplies being closed due to contamination. Five of the river basins have had two occurrences of public water supplies being closed.

The contamination of these water supplies has been discovered through routine testing (14), the SPOT (State Purgeable Organic Testing Program) program (5), special testing on request from the town (8) and miscellaneous means (17). The public water supplies have been closed down by DEQE alone, the town or water authority alone or jointly by DEQE and the town.

According to the Massachusetts Drinking Water Regulations, water supplies are required to be monitored for specific microbiological, inorganic and organic contaminants. Microbiological contaminant monitoring is conducted by the town at regular timed intervals, in numbers proportionate to the population for the respective public water supply. Water supplies also test every three years for chemical, nutrient, organic and inorganic parameters according to specified monitoring requirements.

In the SPOT program developed in 1980 by the state and EPA, the Department tested about 1000 groundwater supply wells for volatile organics. This one-time survey resulted in the closure of five public water supplies.

The sources of contamination which resulted in the closure of these thirty-six community public water supplies included thirteen (13) unknown causes, twelve (12) due to industrial contamination (spills, illegal dumping and leaking sewer lines), five (5) from landfills, six (6) from leaking underground storage tanks and gasoline contamination, six (6) from salt, (road salt runoff, salt storage, or seawater infiltration) three (3) from pesticide use and one surface water supply closed from overdevelopment of the watershed. Organic chemicals were responsible for thirty-one (31) or 67% of these forty-six community closings. It appears that industrial activities may pose the greatest threat to our water supplies and such activities located within the recharge area of a water supply well or watershed of a surface water supply should be monitored closely.

Of the forty-six water supplies that have been closed, eight have been fully reopened, four communities joined the Metropolitan District Commission water supply, other communities have recovered part of their lost supply and the remainder are still closed. Under the Act of 1982, Chapter 286 has allocated ten million dollars to be used by communities within Massachusetts for the study and cleanup of contaminated water supplies. Sixteen (16) of these communities have been recommended by the Division of Water Supply to receive funding in the hopes of restoring the contaminated source to water supply use.

GROUNDWATER PROTECTION PROGRAMS

With the increased demand for public water supplies, and closing of water supplies due to contamination, there is a realization that groundwater protection is needed. With the increasing urbanization and industrialization, groundwater protection is becoming an increasingly more difficult problem. Due to the high cost of restoring contaminated waters to drinkable quality, the logical approach to controlling contamination is through prevention.

The state has implemented a groundwater program consisting of the development of fourteen (14) different activities. These activities include public information, participation and education; research and development and groundwater classification; groundwater monitoring; and hydrogeologic study reviews.

The Safe Drinking Water Act, Clean Water Act, Resource Conservation and Recovery Act, Underground Injection Control Program and Emergency Response Effort, with the proper coordination and administration of existing regulations, is providing some control on the protection of groundwater. In the Acts of 1982, Chapter 286 gives the DEQE broad authority to prevent and cleanup public water supply contamination and underwrites it with a ten million dollar bond issue.

Groundwater contamination cleanup is also funded under the Office of Incident Response. The Massachusetts Environmental Emergency Response Plan, which uses a "revolving fund" to provide funds for the assessment and cleanup of spills of hydrocarbons and hazardous materials. Criteria and procedures for the operation of each program are specific to each Division.

DEQE has developed a "Water Supply Protection Atlas" to assess the potential for contamination of ground and surface water supplies. The Atlas consists of four transparent overlays which identify public drinking water supplies, permitted discharges, waste sites (landfills, junkyards, salt storage and hazardous waste) and surface drainage. By juxtaposing these overlays, these maps can be used to illustrate the relationship of existing or planned water supplies to known or possible sources of groundwater contamination, including the possibility of infiltrative pumping of contaminated surface water. These maps will aid in the prevention of some types of pollution simply by identifying particular activities as possible pollution sources. By use of the maps and associated data, it may be possible to track contamination incidents back to their sources.

The majority of the state is underlain with bedrock, allowing smaller and shallower groundwater storage than the midwestern and western sections of the country. Groundwater recharge is primarily from precipitation at an average annual rate of about 40 inches near the coast and 60 inches in the Berkshires. The recharge depends on the slope, soil permeability and vegetation.

The southeast corner of Massacnusetts (Cape Cod and the Islands) is all stratified glacial drift aquifers. All public water supplies are gravel packed wells less than 100 feet deep. The greatest threat to water quality in these highly permeable aquifers is sewage disposal through septic systems and municipal systems, landfills, road-salt, agriculture, pesticides, saltwater intrusion and underground leaking tanks. Several water supplies and private wells nave been closed due to these factors and no other water is available. Sound management of the aquifer is critical to Cape Cod. In July 1985, EPA and DEQE announced a two year pilot project integrating federal, state and local programs to protect the Cape's groundwater resources.

GROUNDWATER DISCHARGE PERMIT PROGRAM

On October 15, 1983, the Massachusetts Department of Environmental Quality Engineering (DEQE), Division of Water Pollution Control, promulgated two regulations establishing the Massachusetts Groundwater Discharge Permit Program and the Massachusetts Groundwater Quality Standards. These two regulations, respectively identified as Title 314 of the Code of Massachusetts Regulations Chapters 5.00 and 6.00 (314 CMR 5.00 and 6.00), were designed to provide for the protection of all groundwaters of the Commonwealth. Major features of the regulations include a state-wide groundwater classification program and groundwater discharge permit enforcement authority. Under the former, a mechanism has been created for the classification of the Commonwealth's groundwaters with respect to protecting its most sensitive use. The three classes of groundwaters are:

Class I: Fresh groundwater found in the saturated zone of unconsolidated deposits or unconsolidated rock and bed rock and are designated as a real or potential source of potable water supply.

Class II: Saline waters found in the saturated zone of the unconsolidated deposits or consolidated rock and bed rock are designed as a source of potable mineral waters, for conversion to fresh potable waters, or as raw material for the manufacture of sodium chloride or its derivatives or similar products.

Class III: Fresh or Saline waters found in the saturated zone of unconsolidated deposits or consolidated rock and bed rock and are designed for uses other than that as a source of potable water supply. The most sensitive use of these waters is as a source of non-potable water which may come in contact with, but is not ingested by humans.

Under 314 CMR 6.00, persons desiring a particular classification for a groundwater were given until January 1, 1985 to submit a petition of request to DEQE. DEQE is currently reviewing all such requests and will assign classifications based upon the submitted data. Groundwaters for which no specific classification petitions have been received, will be designated as Class I, thereby affording protection to the most sensitive use - drinking water supply.

Reclassification may also be initiated by a petition for reclassification which will be accepted at any time. Currently, 87 such petitions are being processed by the Department.

All petitions must include certain minimum information including a description of the existing groundwater quality, current and potential uses of the groundwaters, identification of potentially affected water supplies, and a statement of need. Petitioners may also be required to submit a hydrogeologic study, the required detail of which will depend on the complexity of the areas geology, hydrology and the potential environmental impacts.

Standards for granting a Class III designation include the following:

1) The groundwater impacted by the classification is under single ownership by the discharger proposing the classification; or

2) The groundwater affected by the classification is not a present or potential source of drinking water because

   a) the depth of location of the groundwater makes its use as drinking water economically or technologically infeasible; or

   b) the groundwater is sufficiently contaminated to make its recovery for drinking water use economically or technologically infeasible; or

   c) the discharge is located over a federally-defined Class III well mining area subject to subsidence or catastrophic collapse; or

3) The groundwater affected is a potential source of drinking water, but an alternate source is available and will be provided by the discharger proposing the classification to all existing and potential users of the aquifer affected by the discharge.

Furthermore, once all the above have been fully satisfied, the State will consider potential adverse effects on hydrologically connected surface and groundwaters. The State must take into account future as well as present uses of adjacent water and groundwater.

Currently, the protection of groundwater from point sources of pollution is accomplished through the Department's Groundwater Discharge Permit Program administered by the Division of Water Pollution Control. All dischargers of pollutants into the groundwaters require a wastewater discharge permit. This includes, but is not limited to: facilities discharging a liquid effluent below the land surface or into a percolation pit, pond or lagoon; facilities discharging a liquid effluent into leaching pits, galleries, chambers, trenches, fields and pipes; facilities discharging a liquid effluent into an injection well; any facility with an unlined pit, pond, lagoon or surface impoundment in which wastewaters or sludges are collected, stored, treated or disposed of; or conveyances that collect and convey storm water run off contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances or contact with a leaching facility. Since adoption of the 1983 regulations, the Department has received 288 permit applications and has issued approximately 97 final permits.

Discharges to Class I and Class II groundwaters must meet the more stringent of either the technology standards or the national primary and secondary drinking water standards. For parameters for which there are not drinking water standards, USEPA Health Advisories are used as effluent concentration guidelines. Compounds which are considered toxic and for which there is neither a water quality standard nor a health advisory, are prohibited from being discharged.

The discharge of sanitary wastewater in excess of 15,000 gallons per day requires a minimum of secondary wastewater treatment or its equivalent. All industrial process wastewater discharges are required to meet technology standards and the proposed treatment system must receive Department approval. These measures serve to ensure that the permitted discharge will be in compliance with Class I or Class II standards.

Discharge to Class III groundwaters must also meet the more stringent of technology standards or water quality standards, but water quality standards for Class III groundwaters are determined on a case-by-case basis and are generally less stringent than those for Class I or Class II aquifers. Water quality standards for Class III groundwaters are determined based upon two most sensitive identifiable water uses. At a minimum Class III groundwaters must meet water quality criteria based upon human exposure limits.

In Massachusetts, each permit must contain monitoring requirements to assure compliance with permit limitations and conditions. The Department of Environmental Quality Engineering determines the number of wells, location, dimensions, method of construction, and frequency of reporting on a case-by-case basis. The State has established guidelines for making these determinations, and the guidelines vary according to the type of facility and the aquifer type under consideration. For Class I and Class II groundwater, most of the monitoring will occur at the point where the effluent emerges from a treatment works, disposal system, outlet or point source prior to being discharged into the ground. For Class III groundwater, the State will require monitoring between the point source and the compliance boundary.

An integral part of the groundwater discharge permit program is the permit review process which encompasses all the divisions within the Department such as Water Supply, Water Pollution Control, and Solid and Hazardous Waste. The review process ensures that the environmental concerns particular to each division within the Department are considered and addressed.

WATER POLLUTION CONTROL PROGRAMS

MUNICIPAL FACILITIES BRANCH

The Construction Grants Section of the Division of Water Pollution Control administers grants to municipalities for initial planning, design and construction of new wastewater treatment facilities, or the upgrading of old facilities which are not meeting their NPDES permits. Ninety percent of state-only grants are made for the preliminary and final planning steps. Under the joint EPA/State program, the federal and state shares are 55% and 35%, respectively. Massachusetts receives $83 million annually as its allocation of the $2.4 billion national appropriation. This allocation, however, falls far short when compared to the current statewide inventory of unfunded projects totaling more than $2 billion.

In an effort to effectively respond to the tremendous backlog of outstanding municipal wastewater needs, Governor Dukakis recently signed into law Chapter 786 of the Acts of 1985 which provides $357 million over the next several years as follows:

A) $225 million for the state match to the EPA grant;

B) $80 million for a state-only 70% grant program; and

C) $52 million additional funds (over and above the present $12 million per year) to fund 50% state-only grants for collection sewers and economic benefit projects.

One of the most significant provisions of this law allows the state share to increase to 55% and reduce the EPA share to 35%. With this state funding it will be possible to accelerate the EPA/State grant program to commence construction on approximately $600 million of water pollution control projects during the next three years while federal funds are still available.

It is important to note that the reauthorization of the Federal Clean Water Act will likely phase out the construction grants program by transforming it from a grant base to a loan base program over the next several years. This clearly presents the most challenging period of time for our municipal water pollution cleanup efforts. In particular, projects associated with Boston Harbor cleanup, protection of groundwater resources, ocean sanctuaries, correction of combined sewer overflows, municipal compliance, and other very sensitive environmental problems must be dealt with utilizing new and innovative approaches.

From a historical perspective, the success of this program has been dramatic. Through the investment of approximately 20 billion dollars in federal/state/local funds over the past several years, water quality has improved from 444/444/723 miles (supporting classification/partially supporting/not supporting) in 1972 to 802/572/302 in 1986. The quality of industrial discharges has improved because treatment facilities have been built and upgraded, companies have tied into municipal sewerage systems or companies relocated. The major problems with industrial discharges are toxics, treated plating wastes discharging to low flow streams, and the need for better pretreatment. Significant segments of the Hoosic, Millers, Charles and Merrimack Rivers have improved dramatically due to municipal facilities construction.

Massachusetts has 205 permitted municipal discharges and 765 permitted industrial discharges, fourteen of which were newly added in 1985. Of these 970 permits, over two-thirds are in compliance with their effluent limits. Although their effluents meet the designated limits, some do not meet the required monitoring and sampling requirements. Since the program began over 500 Administrative Orders have been issued to companies, communities and industries. Some of those whose received Administrative Orders have since complied or gone out of business.

NONPOINT SOURCE POLLUTION

Nonpoint sources (NPS) impact the rivers and lakes more than is realized. The rivers of Massachusetts appear to be in non-support of the classification as a result of non-point sources 23.7 percent of the time (Taole 3). Nonpoint sources were listed 26 times out of 34 basins as the most common cause. When non-support percentages from in-place sediments (7.1%), agriculture (2.2%) and natural conditions (13.5%) are also added to the non-support source/ urban runoff breakdown a total percentage of 46.5% is reached. Thus nonpoint sources account for almost half of the rivers non-support classification in Massachusetts.

Point source discharges are being controlled and monitored while nonpoint source pollution problems have only recently been addressed. The major components of nonpoint sources which have water quality impacts are urban runoff, nutrient loadings from agricultural and dairy lands, landfills and buried wastes, failing septic systems and groundwater contamination.

Lakes and ponds are more severely impacted by NPS than rivers in Massachusetts. Direct point discharges to lakes are nearly non-existent; thus watershed management plans to control NPS are an integral part of lake restoration projects.

Most implementation of NPS control is conducted on a local level such as street sweeping, road salt containment and fertilizer application control. Concern is mounting over groundwater contamination from NPS; some communities have initiated watershed management programs to control NPS impacts.

Improvements to failing septic systems and leaky sewer lines are being made with the allocation of money for sewer tie-ins. This particularly helps along lake and river shorelines where flooding of the water causes septic tank failures and groundwater contamination. New landfill regulations will provide better control and collection of leachate contamination, preventing volatile organics and metals from entering the groundwater.

NONPOINT SOURCE CONTROL PROGRAM

Massachusetts is now in the process of developing a state-wide comprehensive nonpoint source pollution control program. Although many existing environmental programs now include or somehow relate to nonpoint sources of pollution, the current effort will have this issue as its prime focus. As a first step, there will be an identification of those waters which, because of nonpoint source pollution, are (a) not meeting water quality standards, or (b) not meeting the goals and requirements of the federal or state Clean Water Acts. Included are rivers, streams, coastal waters and groundwater. The state's Clean Lakes Program addresses nonpoint source pollution to lakes and ponds in an adequate fashion.

Subsequent to the above first-step the Division will:

- Identify the categories of nonpoint source pollution degrading the waters;
- identify best management practices (BMP's) to address the categories;
- identify appropriate programs (federal, state, local) and financial resources for implementation of the BMP's; and
- administer implementation projects prioritized on a watersned by watershed basis.

There is a possibility of creating a nonpoint source grant program which would work in concert with the proposed nonpoint source program amendment to the federal Clean Water Act. This action will be evaluated after a statewide assessment of nonpoint source problems has been completed.

SOLID AND HAZARDOUS WASTE PROGRAMS

The Division of Solid and Hazardous Waste was established by the Legislature in November 1979 for the purpose of developing, implementing and enforcing a hazardous waste regulatory program that encourages sound management and safe treatment of hazardous waste. This Division operates in compliance with all federal environmental statutes, coordinating its activities with the Federal Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation & Liability Act (CERCLA, also known as the Superfund Act). It is responsible for enforcing certain state environmental acts and regulations, namely Ch. 21C (the Hazardous Waste Management Act), Ch. 21E (State Superfund Program), and Ch. 111, Section 150A (the Solid Waste Disposal Act).

Implementing each of these responsibilities is a major undertaking. The rate of growth required to fulfill these new mandates is unprecedented in the history of the Department. It has challenged both the Division and the Department to manage this growth so that adequate support systems are available for the new programs as well as existing staff.

Also, implementing these responsibilities is complicated by the uncertainties that arise from implementing a regulatory program in an area which is technically moving into new ground. The understanding of toxic substances and their potential impact on public health and the environment is constantly evolving. Thus, the Division is dealing with relatively new problems and faced with developing solutions that sometimes push the limits of available technology. In short, it needs to ensure that, in meeting its objective of cleaning up hazardous waste problems as quickly as possible, it does not outstrip the technical ability to implement solutions that will be effective over the long term. The pace at which it meets its mandate must always be tempered by technological reality.

The Division regulates three major programs:

(1) the Hazardous Waste Regulatory Program;

(2) the Office of Incident Response; and

(3) the Solid Waste Program.

The Hazardous Waste Regulatory Program, which was started when the Division was formed in 1980, set as its goal the establishment of an effective program within the decade. Today, the regulatory structure for this program is largely in place, although the 1984 reauthorization of RCRA by Congress has brought new responsibilities. Now this unit is shifting its efforts from program development to program implementation. The new programs emphasize inspecting and licensing hazardous waste handlers, as well as monitoring compliance with the regulations.

Since 1983, major strides have been made toward identifying businesses subject to regulation and bringing them into the system. The Division has increased the rate at which hazardous waste handlers are inspected. The Division has called in permit applications from facilities which have been authorized on an

interim basis to treat, store or dispose of hazardous wastes. These applications are being reviewed for their compliance with the hazardous waste regulations. In addition, the Division operates a program for licensing hazardous waste transporters, a program which the U.S. General Accounting Office has called the most stringent in the country. Finally, the Division has increased its capacity to take enforcement actions against major violators of the hazardous waste laws, and has maintained an excellent record for obtaining convictions. To summarize the record, everyone has seen improvements in the attitude and response of business and industry toward proper waste management.

The Office of Incident Response is responsible for containing and mitigating environmental damage caused by chemicals released in emergency spill situations and at sites where dumping has occurred in the past. The Massachusetts Oil and Hazardous Materials Act of 1983 (G.L. c. 21E) requires the Division to establish both regulatory and response programs to meet these goals. Since 1983, the Office of Incident Response has focused its energies in two areas: (1) mitigating imminent threats to the environment caused by hazardous waste spills and sites, and (2) developing the institutional infrastructure that will increase its capacity to effect long term solutions to such problems.

Major actions taken by this program include the expansion of the scope and level of effort of the state's existing emergency response contract and developing and implementing a new contract that significantly expands the Division's capacity to assess sites and plan remedial actions. The Division has instituted systems to recover costs spent by DEQE and its contractors at sites and spills where responsible parties are unwilling or unable to initiate cleanup measures in a timely way. Finally, hazardous waste sites are being moved through the assessment and cleanup process more quickly as staff increases.

It is estimated that over $30 million has been spent by responsible parties in responding to releases of oil and hazardous materials. EPA has either allocated or spent $26 million for federal Superfund sites. The state has spent $8.5 million on site assessments and remedial actions.

The Solid Waste Management Program is presently assessing its needs to determine the resources needed to manage a comprehensive program. Such a program will address current capacity as well as the urgent need to protect water resources from unsound disposal practices. Between 1980 and 1985 this program was virtually unfunded. During this time field staff were available to inspect landfills and follow up with enforcement actions only in response to crises. The Division has now begun a major effort to develop a solid waste disposal program that will provide maximum protection for the Commonwealth's natural resources.

MONITORING PROGRAMS

A. RIVER MONITORING

There are two types of surveys conducted on the rivers of the Commonwealth. These surveys include all major components (including tributaries and wastewater inputs) and are composed of physical, chemical and biological parameters (see Table below). There are one day, one run surveys of grab samples only, and the intensive surveys are round-the-clock sampling for two to three consecutive days during one to two weeks of the summer during low flow conditions. Intensive survey samples are usually composited.

TABLE 9
TYPICAL SURVEY ANALYSES

Type	Parameter
Physical	Flow
	Temperature
	Transparency
	Suspended Solids
	pH
Chemical	Dissolved oxygen
	BOD
	Nutrients
	Chlorides
	Trace elements
Biological	Chlorophyll a
	Coliform bacteria
	Phytoplankton
Special	Metals
	Organics

River stations are located at dams, above and below discharges, at tributaries, and at impoundments. These locations are chosen to assess the water quality and effects of outside sources and natural changes. Surveys are conducted periodically to update old data and sample rivers before and after a major upgrading of a treatment plant or the addition of a new discharge. The surveys conducted in 1984 and 1985 are listed in Table 10.

Once sampling is conducted four different reports are written: the tabulation of Water Quality Data, Wastewater Discharge Data, a comprehensive Water Quality Analysis and a Management Plan for the entire river basin.

TABLE 10
1984 AND 1985 SURVEYS CONDUCTED

YEAR	BASIN	SURVEYS
1984	Boston Harbor	4 surveys
	Charles River	2 intensive surveys
	Lower Connecticut River	2 intensive surveys
	French River	1 intensive survey
	Parker River	1 survey
	Rumford/Threemile River	1 survey
	Ten Mile River	5 intensive surveys
1985	Assabet River	12 surveys
	Blackstone River	1 intensive survey
	Boston Harbor	4 intensive surveys
	Buzzards Bay	2 intensive surveys
	Chicopee River	2 surveys
	French & Quinebaug Rivers	2 surveys
	Hoosic River	2 intensive surveys
	Housatonic River	2 intensive surveys
	Ipswich River	3 surveys
	Merrimack River	4 surveys
	Millers River	3 surveys
	Nashua River	4 surveys
	North Coastal	1 intensive survey
	Westfield River	1 intensive survey

HARBOR MONITORING

Harbor and coastal monitoring is a relatively new area for the Division with the first surveys conducted ten years ago. Surveys consist of grab samples taken one meter below the surface of the water. On some occasions a variety of depths at one location may be analyzed. Samples are analyzed for physical, chemical and biological parameters (Table 9). A Hydrolab has recently been added to the sampling regime, measuring the salinity, temperature and dissolved oxygen profiles for the entire depth. Harbor station locations are based on circulation patterns and known waste inputs.

Amendments to the Clean Water Act of 1977, Section 301(h) allowed existing marine dischargers a one-time opportunity to investigate the environmental impact of primary effluent discharges and to apply for a waiver of secondary treatment requirements. Subsequent challenges caused Congress to pass further amendments in December 1981 and again in 1983.

Municipalities applying for a modified permit to waive secondary treatment requirements must document that the impact of their existing or proposed effluent discharge will not impair water quality, threaten biological communities or result in any increase of toxic pollutants to the receiving waters, and will be achieved cost-effectively. Applications fully addressed all these elements with extensive water quality, biological and oceanographic studies. Calculations and models were run to predict the zone of initial dilution, pollutant fates, solids distribution, anticipated biological changes and other impacts that may be experienced be receiving water uses.

These 301(h) waiver studies have provided extensive oceanographic and harbor monitoring data to supplement other data available. A new coastal monitoring section is being initiated and will begin extensive studies and other analyses in 1986. Clean up recommendations and enforcements should thus be carried out in a more timely and practicable manner.

LAKES AND PONDS MONITORING

The Division's Lakes Monitoring Program was formally initiated in the summer of 1974 and has significantly expanded its scope over the past decade. Two different sampling programs are conducted by the lakes section: baseline surveys and intensive surveys.

A baseline survey consists of bathymetric mapping, qualitative and density mapping of the vascular aquatic plants, chemical, bacteriological and biological sampling of the open water areas. Chemical and bacteriological samples are also taken of the natural inlets and the outlet. The lake is sampled once during the summer months.

Intensive lake surveys consist of a minimum of six surveys conducted during a one-year period with sampling performed in each season. Physical, chemical and biological data are collected during each sampling run as in the baseline surveys. Historical, cultural and soils watershed information are later gathered to supplement the water quality data.

The results of these surveys are necessary to achieve the objectives of the Lakes Monitoring Program. Baseline data are used to classify the lakes and ponds of Massachusetts. This information will aid in developing a comprehensive lake restoration-preservation program and aid in evaluating the impact of shoreline development on these lakes and ponds. To date 462 lakes and ponds have been classified totaling 46,299 acres.

COMPLIANCE MONITORING

The National Pollutant Discharge Elimination System (NPDES) was established as part of PL 92-500. It requires all dischargers of pollutants to a waterbody to obtain a permit to discharge. A pollution abatement schedule may be established to fulfill the goals of NPDES. Monitoring of these wastewater discharges is required to assure compliance with the terms of the discharge permits and is performed by the permitee. DWPC personnel spot check dischargers to corroborate results. Samples are split with the permit holders when possible to reduce differences in reported values. Monitoring of permit holders is coordinated with the water quality river sampling program to provide data for mathematical models and to be used in determining the contaminants (if any) of the discharger to the water. Approximately 125 discharges are sampled each year. Discharge samples range from 3 day, 24-hour composites on major municipal facilities to grab samples on some minor industrial discharges.

Twenty-four hour composite samples are taken with an Isco sampler, sampling approximately 350 ml each hour. The individual bottles are then aliquoted and composited into one time-based sample. Aliquots are either flow based or in equal portions. The parameters for analysis on each sample will depend upon the nature of the discharge and the terms of the discharge permit.

Special studies are occassionally conducted on individual wastewater treatment plants. These studies include intensive sampling throughout the process from the influent to the effluent. These analyses help determine treatment effectiveness and capacities.

TECHNICAL ASSISTANCE AND TRAINING

The Technical Assistance and Training Section will be responsible for providing technical assistance and training to wastewater treatment plant operators throughout the Commonwealth. Technical Assistance efforts will focus upon developing and maintaining an inventory of problem plants and documenting assistance provided to them. Documentation includes an assessment of the problems, actions taken, recommendations made, and the result of corrective measures employed. Responsibilities of the section are to perform diagnostic evaluations; on-site assistance to improve performance; operation, maintenance, and staffing evaluations; follow-up site inspections to determine the efficiency of plant performance after assistance efforts, and in general to limit the number of facilities in non-compliance with their NPDES permits. The section is also responsible for the review of operation and maintenance manuals as related to 314 CMR 12.00. This regulation established procedures for proper operation of treatment works, proper certification of staffing, sewer system extensions and connections, pretreatment, maintenance of treatments, sampling, analysis of record keeping, and O&M safety.

The training program for wastewater operators will be expanded in FY'86. The basic wastewater treatment operations course will be offered four times and a new industrial waste operations course will be offered twice. In addition seminars are planned on a variety of wastewater topics in the areas of operations, laboratory, management, and maintenance.

It is expected that combined with the aforementioned duties that a considerable amount of time will be devoted to training new TA/T personnel entering the section. Efforts will be made to provide this training in a timely manner so that efforts of the section may be expanded in the future.

BIOLOGICAL MONITORING

The Biological Monitoring Program is part of the water quality monitoring program which is authorized by the Massachusetts Clean Waters Act, Section 27, paragraph 5. The importance of the program is recognized in the "Declaration of Goals and Policy" Section 101(a) of Public Law 92-500 which stresses the need to restore the biological integrity of the nation's waters and achieve a water quality which provides for the protection and propagation of aquatic life. Aquatic organisms are very efficient pollution monitors because they integrate the effects of water quality over long periods of time and show the ill effects of spills or chronic discharges of toxic substances, brief sags in dissolved oxygen concentrations and other short-lived episodes that could otherwise be detected only by maintaining continuous chemical monitoring programs, or not at all.

The program consists of the following elements:

1) Stream Classification -

This program has been developed to systematically sample and classify the Commonwealth's rivers and streams. Each survey provides documentation of a specific watercourses' physical and chemical characteristics and predominant biological components. These data can be used - on a stream or site-specific basis - to determine water-use classifications in accordance with Massachusetts Surface Water Quality Standards.

2) Rapid Assessment of Water Quality -

As a supplement to the collection of traditional physicochemical information, various aquatic communities representing different levels of the food chain are sampled in order to determine the effects of conventional and toxic pollutants on the receiving waters. Rapid assessment surveys involve the use of qualitative and semi-quantitative sampling methods designed to minimize laboratory time requirements for taxonomic identification and enumeration of organisms. Rapid assessments make use of the qualitative analysis of periphyton, aquatic and wetland vegetation, and fish communities, and semi-quantitative sampling and analytical methods for assessing the macroinvertebrate community.

3) Site Assessments and Intensive Surveys -

Depending upon specific goals and objectives these surveys might include qualitative, rapid assessment, or quantitative evaluations of one or more aquatic community. Futhermore, they may range in scope from a qualitative impact assessment of a single wastewater discharge on a single community to quantitative assessments of one or more communities throughout an entire river system or watershed. Obviously the latter can be very labor and resource intensive and are limited to those occasions when the need exists for statistically derived statements of confidence in the data.

4) Toxic Chemicals in Fish -

This program involves the collection of finfish from selected water bodies for various tissue analyses for toxic contaminants. These include, but are not limited to, heavy metals, PCB's, PAH's, and dioxin. The program will establish a statewide data base of levels of toxic contaminants in fish for use in assessing potential impacts on aquatic life and public health, and for making water quality management decisions such as setting standards and issuing NPDES wastewater discharge permits.

5) Toxicity Testing -

Present in-house toxicity testing capabilities are limited to use of the Beckman Instruments, Inc. Microtox™ toxicity analyzer which uses lyophilized marine bacteria (Photobacterium phosphoreum), which, when reconstituted, emit a constant level of light. Exposure of the bacteria to a toxicant results in diminished light output in proportion to the magnitude of the toxicant concentration. This system is currently used to assess the relative toxicity of municipal and industrial wastewater discharges and to measure the persistence of toxic impacts in receiving waters. Toxicity testing by other laboratory methods are conducted under a cooperative agreement with the U.S. EPA New England Regional Laboratory in Lexington, MA. This laboratory conducts acute toxicity tests using fathead minnows and cladocerans (Daphnia spp.), and chronic tests using Ceriodaphnia spp. The DEQE recognizes the need for developing in-house capabilities for conducting the toxicity tests currently being performed by the U.S. EPA. To meet this need, a program is being developed to provide laboratory facilities and personnel at the office of the Technical Services Branch in Westborough.

6) Biological Support Laboratory -

The Biology Program maintains a support laboratory which conducts phytoplankton identifications and counts, and chlorophyll a determinations on samples provided as part of the lakes and rivers water quality monitoring programs.

TABLE 11
BIOMONITORING PROJECTS 1981 - 1985

RIVER BASIN	WATER BODY	SURVEY TYPE	YEAR
Hoosic	Hoosic River	Rapid Assessment Toxics in Fish	1984, 1985 1985
Deerfield	Deerfield River	Classification	1983
Connecticut	Lower Connecticut River	Toxics in Fish	1985
Millers	Millers River	Toxics in Fish	1985
French	French River	Site Assessment	1984
Blackstone	Blackstone River	Rapid Assessment Toxics in Fish	1985 1985
Ten Mile	Ten Mile River	Rapid Assessment Toxics in Fish	1984 1984
Taunton	Matfield River Meadow Brook Coopers Pond, Attleboro	Rapid Assessment Site Assessment Site Assessment	1983 1981 1984
Charles	Lake Winthrop	Toxics in Fish	1984, 1985
Weymouth	Cochato River	Toxics in Fish	1985
Nashua	Nashua River	Rapid Assessment Toxics in Fish	1985 1985
	Mason Brook	Site Assessment	1985
Concord	Assabet River Hocomonco Pond Sudbury River River Meadow Brook	Toxics in Fish Site Assessment Toxics in Fish Toxics in Fish Site Assessment	1985 1985 1985 1985 1984
Merrimack	Flint Pond Unnamed Tributary	Toxics in Fish Site Assessment	1985 1984
Parker	Parker River	Classification	1984
South Shore	North River	Classification	1983
Cape Cod	Herring River	Rapid Assessment	1983

ACID RAIN MONITORING

Massachusetts is making an effort to learn about the sensitivity of its water resources to acid rain. The Massachusetts Water Resource Research Center at the University of Massachusetts, together with environmental groups and over 800 citizen volunteers in an effort known as "the Acid Rain Monitoring Project" (ARM) have collected samples from lakes, streams and reservoirs. These samples are brought to certified laboratories where volunteer professionals analyze the water chemistry within 24 hours and according to standard procedures. Funding comes from Trout Unlimited, and the Massachusetts Division of Fisheries and Wildlife.

In this project, alkalinity is used to determine the effect of the acid rain. As acidity increases, pH drops and alkalinity, which neutralizes acidity, decreases. Eventually the alkalinity is reduced to zero, the pH in the rain is not buffered, and the acidity increases. Water alkalinities below 20 ppm are considered sensitive and below 5 ppm are considered critical.

TABLE 12
ALKALINITY IN WATERBODIES

Sensitivity Category	Alkalinity (ppm)	Water Bodies	
		Percent	Number
Acidified	0≤, (pH<5.0)	5	42
Critical	0-≤2	14	117
Endangered	2-≤5	17	140
Highly Sensitive	5-≤10	21	173
Sensitive	10-≤20	21	174
Not Sensitive	≥20	22	183

Division of Fisheries and Wildlife, May-June 1985

Results of ARM phase I. Approximately 19% of our surface waters have lost most or all of their alkalinity (ability to resist acid influx).

From the ARM project the sensitivity of 2000 surface waters (Phase I) in the Commonwealth is known and the preliminary knowledge of 2500 (Phase II) is known. From Phase I it has been determined that approximately 19% of the state's surface waters have lost most or all of their alkalinity and are considered potentially acid altered.

The most impacted areas in Massachusetts are northern Worcester County and Barnstable, Plymouth and Bristol counties. Quabbin Reservoir, the drinking water source for Boston and vicinities, is located in Franklin, Hampshire, and Hampden counties. Due to the acid rain, excessive amounts of sodium hydroxide must be added to the drinking water to raise the pH enough to reduce the solubility of lead prevalent in the pipes of the service lines. Fish are also being affected and reduced populations have been observed in a few selective lakes and streams.

This study is projected to continue for many more years. Additional lakes will be sampled each year and actions taken to control the problems. The state is currently researching treatment techniques and monitoring damage status. For example, a study to test drinking water for metals is proposed. This study will show the extent of elevated heavy metals due to corrosive water reacting with household pipes.

The state will continue its research and efforts to win federal cooperation. Acid rain is threatening the water quality; damaging aquatic life, forests and buildings; and leaching metals and nutrients from the soils and pipes. Only strong action at the federal level will ease this problem.

SPECIAL CONCERNS

Water quality in the state of Massachusetts has been improving, yet many rivers, lakes, harbors and groundwater supplies continue to remain in violation of standards. Continued degradation is caused by many different problems. The Department is addressing these special concerns by developing new programs, studying situations and causes, and modifying existing programs and regulations. Funding appears to be the major drawback to implementing these programs.

The special concerns and recommendations are listed below:

1) Wide Spread Contamination of Water Supply Systems

Increasing numbers of public and private water supply systems are being closed due to contamination. Treatment methods for existing contaminated supplies are being studied and protection for new or existing water supplies are being initiated. Several towns are buying land surrounding the wells or reservoirs and establishing building zones near recharging aquifers. Funding is a major drawback in all these recommendations.

2) Proper Containment of Hazardous Waste Sites

Through the enactment of the Massachusetts Oil and Hazardous Material Release and Prevention Act, spills and leaks are being contained immediately. New hazardous waste sites are being discovered and studied and tighter regulations are preventing some of the illegal dumping that used to occur. Problems occur in inadequate funding and lack of personnel to clean up the sites.

3) Coastal Water Quality Degradation

The coastal and marine waters of the Commonwealth have only recently been studied. Major pollutant problems and health hazards have been documented, causing numerous shellfish closings and fish consumption advisories. Wastewater treatment plants with ocean discharges are being studied, modeled, and assessed. A new coastal monitoring section is being developed within the Department to sample, analyze and assess the coastal water quality degradation. Initial recommendations include upgrading ocean discharges and eliminating combined sewer overflows.

4) Prevention and Control of Nonpoint Sources

Now that industrial plant discharges are being tied in to municipal plants or treated prior to discharging and municipal plants are being upgraded or built, the water quality has improved. Nonpoint source pollution is rapidly becoming the leading cause of degradation in rivers, lakes and harbors. A new Nonpoint Source Pollution Control Program is being established to assess the problem and make recommendations to control nonpoint source pollution. Funding will be necessary to carry out any control actions.

5) Eutrophication of Lakes and Ponds

The Clean Lakes Program in the Department conducts baseline surveys and intensive surveys to classify the lakes and ponds and develop a restoration - preservation program. To date, 62 of the 462 lakes and ponds studied are eutrophic. By controlling shoreline development, constructing outlet structures and implementing clean up and management plans, lake eutrophication can be reduced/prevented.

6) Acidification of Lakes and Ponds Throughout the Commonwealth

The Division of Fisheries and Wildlife and Trout Unlimited along with the University of Massachusetts and 800 citizen volunteers have studied over 4500 surface waters in the Commonwealth. Liming and containment is temporary and expensive treatment which does not deal with the causes of acidification. Under a newly funded federal Acid Precipitation Mitigation Program, Massachusetts is currently in the preliminary stages of initiating a five year research study to determine the cost benefits of installing a neutralization demonstration device on a selected acid impacted stream.

7) Proper Operation of Water and Wastewater Treatment Plants

With all the construction and upgrading of wastewater treatment plants it is imperative they are properly maintained and operated to realize full benefit. The Technical Assistance and Training Section of the Department was started in 1984 and has provided numerous training courses, seminars and the development of recognition award programs and evaluation programs.

8) Evaluation of Chronic Toxicity and Bioaccumulation

Studies of metals in fish flesh and the sampling of benthic macroinvertebrates provide baseline data for water quality evaluation of healthy supporting environments and for the presence of hazardous or toxic substances. A new Microtox™ toxicity testing program was established in 1985 and more intensive toxicity testing is planned. Toxicity data can be used to establish NPDES permit limits and determine the water quality and uses of river segments.

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COMMONWEALTH OF MASSACHUSETTS SUMMARY OF WATER QUALITY 1986

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Appendix I – Massachusetts Surface Water Quality Standards

Massachusetts Department of Environmental Quality Engineering
S. Russell Sylva, Commissioner

DIVISION of WATER POLLUTION CONTROL
Thomas C. McMahon, Director

APPENDIX I

Commonwealth of Massachusetts

Water Resources Commission

Division of Water Pollution Control

MASSACHUSETTS SURFACE WATER QUALITY STANDARDS

4.01: GENERAL PROVISIONS

(1) Title. These regulations shall be known as the "Massachusetts Surface Water Quality Standards."

(2) Organization of Standards. These standards comprise five units: General Provisions (314 CMR 4.01), Application of Standards (314 CMR 4.02), Water Quality Criteria (314 CMR 4.03), Antidegradation Provisions (314 CMR 4.04), and Basin Classification and Maps (314 CMR 4.05).

(3) Authority. The Massachusetts Surface Water Quality Standards are adopted by the Division pursuant to the provisions of M.G.L. c.21, §27.

(4) Purpose. The Massachusetts Act charges the Division with the duty and responsibility to enhance the quality and value of the water resources of the Commonwealth and directs the Division to take all action necessary or appropriate to secure to the Commonwealth the benefits of the Federal Act. The objective of the Federal Act is the restoration and maintenance of the chemical, physical and biological integrity of the Nation's waters. To achieve the foregoing requirements the Division has adopted these standards which designate the uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; which prescribe the water quality criteria required to sustain the designated uses; and which contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges.

(5) Definitions. As used in these standards, the following words have the following meanings:

Artificial conditions - Those conditions resulting from human alteration of the chemical, physical or biological integrity of waters.

Beneficial use - Any use not impairing the most sensitive use designated in the classification tables contained in 314 CMR 4.05; except that in no case shall the assimilation or transport of pollutants be deemed a beneficial use.

Cold water fishery - Waters whose quality is capable of sustaining a year-round population of cold water trout (salmonidae).

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Division - The Massachusetts Division of Water Pollution Control, as established by General Laws c.21, §26.

Discharge - Any addition of any pollutant to the waters of the Commonwealth.

EPA - The United States Environmental Protection Agency.

Federal Act - The Federal Water Pollution Control Act, as amended, 33 U.S.C. §§1251, et seq.

Massachusetts Act - The Massachusetts Clean Waters Act, as amended, General Laws, c.21, §§26-53, inclusive.

Pollutant - Any element or property of sewage, agricultural, industrial or commercial waste, runoff, leachate, heated effluent, or other matter, in whatever form and whether originating at a point or major nonpoint source, which is or may be discharged, drained or otherwise introduced into any sewerage system, treatment works or waters of the Commonwealth.

Primary contact recreation - Any recreation or other water use, such as swimming and water skiing, in which there is prolonged and intimate contact with the water sufficient to constitute a health hazard.

Seasonal cold water fishery - Waters whose quality is capable of sustaining only an extremely limited cold water population on a year-round basis, with cold water fish in these streams provided largely by stocking.

Secondary contact recreation - Any recreation or other water use in which contact with the water is either incidental or accidental, such as fishing, boating and limited contact incident to shoreline activities.

Segment - A finite portion of a water body established by the Division for the purpose of classification.

Surface Waters - All waters other than ground waters within the jurisdiction of the Commonwealth, including without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands and coastal waters.

Warm water fishery - Waters whose quality is not capable of sustaining a year-round cold water or seasonal cold water fishery.

Waters of the Commonwealth - All waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters, and ground waters.

(6) Severability. If any provision of these standards is held invalid, the remainder of these standards shall not be affected thereby.

4.02: APPLICATION OF STANDARDS

(1) Establishment of Effluent Limitations. In regulating discharges of pollutants to surface waters, the Division will limit or prohibit such

discharges to insure that the water quality standards of the receiving waters will be maintained or attained. The determination by the Division of the applicable level of treatment for an individual discharger will be made in the establishment of effluent limitations in the individual discharge permits in accordance with 314 CMR 3.10(3), (4), (5) and (6). In establishing water quality based effluent limitations, the Division must consider natural background conditions, existing discharges, must protect existing downstream uses, and must not interfere with the maintenance and attainment of beneficial uses in downstream waters. Toward this end, the Division may provide a reasonable margin of safety to account for any lack of knowledge concerning the relationship between the pollutants being discharged and their impact on the quality of the receiving waters.

(2) Mixing Zones. In applying these standards, the Division may recognize, where appropriate, a limited mixing zone or zone of initial dilution on a case-by-case basis. The location, size and shape of these zones shall provide for the maximum protection of aquatic resources. At a minimum, mixing zones must:

a) Meet the criteria for aesthetics;

b) Be limited to an area or volume that will minimize interference with the designated uses or established community of aquatic life in the segment;

c) Allow an appropriate zone of passage for migrating fish and other organisms; and

d) Not result in substances accumulating in sediments, aquatic life or food chains to exceed known or predicted safe exposure levels for the health of humans or aquatic life.

(3) Hydrologic Conditions. The Division will determine the most severe hydrologic condition at which water quality standards must be met. In classifying the inland surface waters and in applying these standards to such waters, the critical low flow condition at and above which these standards must be met is the average minimum consecutive seven-day flow to be expected once in ten years, unless otherwise stated by the Division in these standards. In artificially regulated waters, the critical low flow will be established by the Division through agreement with the Federal, state or private interest controlling the flow. The minimum flow established in such agreement will become the critical low flow under this section for those waters covered by the agreement.

(4) Procedures for Sampling and Analysis. For the purpose of collecting, preserving and analyzing samples in connection with these water quality standards, the fifteenth edition of Standard Methods of the Examination of Water and Wastewater published by the American Public Health Association, or Methods for Chemical Analysis of Water and Wastes published by the U.S. Environmental Protection Agency should be used. Where a method is not given in these publications, the latest procedures of the American Society for Testing Materials (ASTM) shall be used, or any other equivalent method approved by the Director.

4.03: MINIMUM WATER QUALITY CRITERIA AND ASSOCIATED USES

(1) Description of Contents. 314 CMR 4.03 sets forth the Classes to be used by the Division in classifying the surface waters according to the uses for which the waters shall be enhanced, maintained and protected. For each class, the most sensitive beneficial uses are identified and minimum criteria for water quality in the water column are established. In interpreting and applying the minimum criteria in 314 CMR 4.03(4), the Division shall consider local conditions including, but not limited to:

a) the characteristics of the biological community;

b) temperature, weather, flow, and physical and chemical characteristics; and

c) synergistic and antagonistic effects of combinations of pollutants.

(2) Coordination with Federal Criteria. The Division will use EPA criteria established puruant to Section 304(a)(1) of the Federal Act as guidance in establishing case-by-case discharge limits for pollutants not specifically listed in these standards but included under the heading "Other Constituents" in 314 CMR 4.03(4), for identifying bioassay application factors and for interpretations of narrative criteria. Where the minimum criteria specifically listed by the Division in this part differ from those contained in the federal criteria, the provisions of the specifically listed criteria in these standards shall apply.

(3) Classes and Designated Uses. The surface waters will be assigned to one of the classes listed below. Each class is defined by the most sensitive, and therefore governing, uses which it is intended to protect. The classes are:

Classes for Inland Waters

Class A - Waters assigned to this class are designated for use as a source of public water supply.

Class B - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; and for primary and secondary contact recreation.

Class C - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.

Classes for Coastal and Marine Waters

Class SA - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting without depuration in approved areas.

Class SB - Waters assigned to this class are designated for the uses of protection and propagation of fish, other aquatic life and wildlife; for primary and secondary contact recreation; and for shellfish harvesting with depuration (Restricted Shellfish Areas).

Class SC - Waters assigned to this class are designated for the protection and propagation of fish, other aquatic life and wildlife; and for secondary contact recreation.

(4) Minimum Criteria. The following minimum criteria are adopted and shall be applicable to all surface waters.

A. These minimum criteria are applicable to all waters of the Commonwealth, unless criteria specified for individual classes are more stringent.

	Parameter	Criteria
1.	Aesthetics	All waters shall be free from pollutants in concentrations or combinations that: a) Settle to form objectionable deposits; b) Float as debris, scum or other matter to form nuisances; c) Produce objectionable odor, color, taste or turbidity; or, d) Result in the dominance of nuisance species.
2.	Radioactive Substances	Shall not exceed the recommended limits of the United States Environmental Protection Agency's National Drinking Water Regulations.
3.	Tainting Substances	Shall not be in concentrations or combinations that produce undesirable flavors in the edible portions of aquatic organisms.
4.	Color, Turbidity, Total Suspended Solids	Shall not be in concentrations or combinations that would exceed the recommended limits on the most sensitive receiving water use.
5.	Oil and Grease	The water surface shall be free from floating oils, grease and petrochemicals and any concentrations or combinations in the water column or sediments that are aesthetically objectionable or deleterious to the biota are prohibited. For oil and grease of petroleum origin the maximum allowable discharge concentration is 15 mg/l.
6.	Nutrients	Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.
7.	Other Constituents	Waters shall be free from pollutants in concentrations or combinations that:

a) Exceed the recommended limits on the most sensitive receiving water use;
b) Injure, are toxic to, or produce adverse physiological or behavioral responses in humans or aquatic life; or,
c) Exceed site-specific safe exposure levels determined by bioassay using sensitive species.

B. Inland Waters - the following additional minimum criteria are applicable to inland water classifications.

For Class A waters:

	Parameter	Criteria
1.	Dissolved Oxygen	Shall be a minimum of 5.0 mg/l in warm water fisheries and a minimum of 6.0 mg/l in cold water fisheries.
2.	Temperature	Shall not exceed 83°F (28.3°C) in warm water fisheries or 68°F (20°C) in cold water fisheries nor shall the rise resulting from artificial origin exceed 4.0°F (2.2°C).
3.	pH	As naturally occurs.
4.	Total Coliform Bacteria	Shall not exceed a log mean for a set of samples of 50 per 100 ml during any monthly sampling period.
5.	Turbidity	None other than of natural origin.
6.	Total Dissolved Solids	Shall not exceed 500 mg/l.
7.	Chlorides	Shall not exceed 250 mg/l.
8.	Sulfates	Shall not exceed 250 mg/l.
9.	Nitrate	Shall not exceed 10 mg/l as nitrogen.

For Class B waters:

	Parameter	Criteria
1.	Dissolved Oxygen	Shall be a minimum of 5.0 mg/l in warm water fisheries and a minimum of 6.0 mg/l in cold water fisheries.
2.	Temperature	Shall not exceed 83°F (28.3°C) in warm water fisheries or 68°F (20°C) in cold water

		fisheries, nor shall the rise resulting from artificial origin exceed 4.0°F (2.2°C).
3.	pH	Shall be in the range of 6.5-8.0 standard units and not more than 0.2 units outside of the naturally occurring range.
4.	Fecal Coliform Bacteria	Shall not exceed a log mean for a set of samples of 200 per 100 ml, nor shall more than 10% of the total samples exceed 400 per 100 ml during any monthly sampling period, except as provided in 310 CMR 4.02(1).

For Class C waters:

	Parameter	Criteria
1.	Dissolved Oxygen	Shall be a minimum of 5.0 mg/l in warm water fisheries and a minimum of 6.0 mg/l in cold water fisheries.
2.	Temperature	Shall not exceed 83°F (28.3°C) in warm water fisheries or 68°F (20°C) in cold water fisheries, nor shall the rise resulting from artificial origin exceed 4.0°F (2.2°C).
3.	pH	Shall be in the range of 6.5-9.0 standard units and not more than 0.2 units outside of the naturally occurring range.
4.	Fecal Coliform Bacteria	Shall not exceed a log mean for a set of samples of 1000 per 100 ml, nor shall more than 10% of the total samples exceed 2500 per 100 ml during any monthly sampling period, except as provided in 310 CMR 4.02(1).

C. Coastal and Marine Waters - the following additional minimum criteria are applicable to coastal and marine waters.

For Class SA waters:

	Parameter	Criteria
1.	Dissolved Oxygen	Shall be a minimum of 85 percent of saturation at water temperatures above 77°F (25°C) and shall be a minimum of 6.0 mg/l at water temperatures of 77°F (25°C) and below.
2.	Temperature Increase	None except where the increase will not exceed the recommended limits on the most sensitive water use.

3.	pH	Shall be in the range of 6.5-8.5 standard units and not more than 0.2 units outside of the naturally occurring range.
4.	Total Coliform Bacteria	Shall not exceed a median value of 70 MPN per 100 ml and not more than 10% of the samples shall exceed 230 MPN per 100 ml in any monthly sampling period.

For Class SB waters:

	Parameter	Criteria
1.	Dissolved Oxygen	Shall be a minimum of 85 percent of saturation at water temperatures above 77°F (25°C) and shall be minimum of 6.0 mg/l at water temperatures of 77°F (25°C) and below.
2.	Temperature Increase	None except where the increase will not exceed the recommended limits on the most sensitive water use.
3.	pH	Shall be in the range of 6.5-8.5 and not more than 0.2 units outside of the naturally occurring range.
4.	Total Coliform Bacteria	Shall not exceed a median value of 700 MPN per 100 ml and not more than 20% of the samples shall exceed 1000 MPN per 100 ml during any monthly sampling period, except as provided in 310 CMR 4.02(1).

For Class SC waters:

	Parameter	Criteria
1.	Dissolved Oxygen	Shall be a minimum of 85 percent of saturation at water temperatures above 77°F (25°C) and shall be a minimum of 6.0 mg/l at water temperatures of 77°F (25°C) and below.
2.	Temperature Increase	None except where the increase will not exceed the recommended limits on the most sensitive water use.
3.	pH	Shall be in the range of 6.5-8.5 standard units and not more than 0.2 units outside the naturally occurring range.
4.	Fecal Coliform Bacteria	Shall not exceed a log mean for a set of samples of 1000 MPN per 100 ml, nor shall more than 10% of the total samples exceed 2500 MPN per 100 ml during any monthly

sampling period, except as provided in 310 CMR 4.02(1).

4.04: ANTIDEGRADATION PROVISIONS

(1) Protection of Existing Uses. In all cases, from and after the date these regulations become effective, the quality of the surface waters shall be maintained and protected to sustain existing beneficial uses.

(2) Protection of High Quality Waters. From and after the date these regulations become effective, waters designated by the Division in 310 CMR 4.05(5) whose quality is or becomes consistantly higher than that quality necessary to sustain the national goal uses shall be maintained at that higher level of quality unless limited degradation is authorized by the Division. Limited degradation may be allowed by the Division as a variance from this regulation as provided in 310 CMR 4.04(6).

(3) Protection of Low Flow Waters. Certain waters will be designated by the Division in Regulation 5.5 of these standards for protection under this section due to their inability to accept pollutant discharges. New or increased discharges of pollutants to waters so designated are prohibited unless a variance is granted by the Division as provided in 314 CMR 4.04(6).

(4) National Resource Waters. Waters which constitute an outstanding national resource as determined by their outstanding recreational, ecological and/or aesthetic values shall be preserved. These waters shall be designated for preservation by the Division in 310 CMR 5.05(5) of these standards. Waters so designated may not be degraded and are not subject to a variance procedure. New discharges of pollutants to such waters are prohibited. Existing discharges shall be eliminated unless the discharger is able to demonstrate that:

a) Alternative means of disposal are not reasonably available or feasible; and,

b) The discharge will not affect the quality of the water as a national resource.

(5) Control of Eutrophication. The discharge of nutrients, primarily phosphorus or nitrogen, to surface waters will be limited or prohibited by the Division as necessary to prevent excessive eutrophication of such waters. There shall be no new or increased discharges of nutrients into lakes and ponds, or tributaries thereto. Existing discharges containing nutrients which encourage eutrophication or growth of weeds or algae shall be treated. Activities which may result in nonpoint discharges of nutrients shall be conducted in accordance with the best management practices reasonably determined by the Division to be necessary to preclude or minimize such discharges of nutrients.

(6) Variances. A variance to authorize a discharge in water designated for protection under 310 CMR 4.04(2) may be allowed by the Division where the applicant demonstrates that:

(a) The proposed degradation will not result in water quality less than specified for the class; and

(b) The adverse economic and social impacts specifically resulting from imposition of controls more stringent than secondary treatment to maintain the higher water quality are substantial and widespread in comparison to other economic factors and are not warranted by a comparison of the economic, social and other benefits to the public resulting from maintenance of the higher quality water. In making such evaluation, the Division will apply, where appropriate, guidance documents published by EPA.

In addition to the above, the applicant for a variance to authorize a discharge into waters designated for protection under 310 CMR 4.04(3) must demonstrate that:

(c) Alternative means of disposal are not reasonably available or feasible.

In any proceeding where such variance is at issue, the Division shall circulate a public notice in accordance with the procedures set forth in M.G.L. c.30A, §3. Said notice shall state that a variance is under consideration by the Division, and indicate the Director's tentative determination relative thereto. To the extent feasible, the variance proceeding shall be conducted as part of any pending discharge permit proceedings pur suant to M.G.L. c.21, §43. In any variance procedure, the burden of proof relative to justifying the variance shall be on the part requesting the variance. Any variance granted pursuant to this regulation shall not extend beyond the expiration date of the permit.

4.05: BASIN CLASSIFICATIONS AND MAPS

(1) Description of Contents. This part sets forth the procedures and guidelines the Division must follow in classifying the waters of the Commonwealth, and the classifications themselves. The procedural rules for classifying are contained in 314 CMR 4.05(2) through 4.05(4). 314 CMR 405(5) contains maps and tabulations identifying the assignment by the Division of each segment to one of the classes set forth in 314 CMR 4.03 of these Standards, the designation of uses and associated criteria for that segment and the imposition of special limitations in 314 CMR 4.04(2) through 4.04(4) to that segment.

(2) Designation of Uses. In determining the appropriate classification for a particular water, the Division must fulfill its statutory mandate as set forth in 314 CMR 4.01(4) of these standards. Wherever attainable, the Division shall designate the national goal uses of protection and propagation of fish, shellfish, aquatic life and wildlife and recreation in and on the waters in classifying the surface waters. In determining whether the national goal uses are attainable for a given water, the Division has considered limitations imposed by natural conditions, irreversible artificial conditions and the availability feasible technological treatment methods and designated the optimum number beneficial uses attainable in the circumstances.

(3) Other Applicable Standards. Waters classified by the Division in 314 CMR 4.05 may be subject to additional restrictions pursuant to federal or Massachusetts statutes and regulations. Where such additional restrictions are known they are noted in the classifications in 314 CMR 4.05. Where these re-

strictions impose requirements more stringent than required under the Massachusetts or Federal Acts, e.g., public health restrictions relative to water supplies, such restrictions shall be considered and applied by the Division in classifying the waters to the extent authorized in the Massachusetts Act.

(4) Fisheries Designations. For inland waters certain specific criteria become applicable on the basis of their designation as a particular type of fishery. Therefore, inland segments are designated as cold water fisheries, seasonal cold water fisheries, warm water fisheries, or for aquatic life. In seasonal cold water fisheries the criteria for cold water fisheries apply during the period of September 15 through June 30 annually, and criteria for warm water fisheries apply at other times.

Where the Division determines that natural or irreversible conditions prevent the attainment of water quality capable of supporting a warm water fishery, a use designation of aquatic life has been made. In each segment so designated in 314 CMR 4.05(5), the criteria for a warm water fishery apply for constituents except those affected by the natural or irreversible condition, which constituents shall be governed by the most sensitive resident species as determined by the Director in consultation with the Massachusetts Division of Fisheries and Wildlife.

(5) Classifications. For the purpose of applying the Massachusetts Surface Water Quality Standards, the surface waters are classified according to water quality and river use.

MASS. EA22.2:C73/986/App.2

COMMONWEALTH OF MASSACHUSETTS SUMMARY OF WATER QUALITY 1986

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Appendix II - Massachusetts Lake Classification Program

Massachusetts Department of Environmental Quality Engineering
S. Russell Sylva, Commissioner

DIVISION of WATER POLLUTION CONTROL
Thomas C. McMahon, Director

APPENDIX II

MASSACHUSETTS LAKE CLASSIFICATION PROGRAM

In accordance with Public Law 95-217, Section 314 (the "Clean Lakes" section of the 1977 Amendments to the Federal Water Pollution Control Act), the Massachusetts Division of Water Pollution Control developed a lake classification program based upon the trophic condition of all publicly owned freshwater lakes and ponds in the Commonwealth.

The Massachusetts Clean Lakes and Great Ponds Program was created under Chapter 628 of the Acts of 1981. An integral part of that program is the prioritization of publicly owned lakes and ponds for the purpose of providing financial assistance to municipalities for diagnostic-feasibility studies and implementation projects. The prioritization process is composed of several elements, one of which is the trophic status of lakes and ponds. The Division utilizes the Lake Classification Program as the basis for awarding priority points in the trophic status category.

A lake or pond is classified according to the system described in this report. The first step in this process is a baseline limnological survey of the lake or pond. This survey is generally conducted in one day and consists of bathymetric mapping of the lake; physical, chemical and biological sampling of the open water areas, tributary stream(s), and outlet; and a quantitative and qualitative mapping of the aquatic macrophyton community in the lake. The primary purpose of this survey is to classify the lake by its trophic status and identify any point and nonpoint sources of pollution. To date the Division has conducted 462 baseline surveys on waterbodies throughout the state.

LAKE CLASSIFICATION SYSTEM

The Division of Water Pollution Control has developed a lake classification system as an aid to setting priorities for the Massachusetts Clean Lakes and Great Ponds Program (Chapter 628 of the Acts of 1981) in Massachusetts. This system is generally applied only to those lakes and ponds for which the Division has collected water quality data. Although a host of physical, chemical, and biological parameters are measured during the normal lake survey, only six critical parameters are employed in the lake classification priority system. The six parameters are hypolimnetic dissolved oxygen, secchi disc reading, phytoplankton count, total ammonia- and nitrate-nitrogen, total phosphorus, and aquatic macrophyton. The most recent survey data are used and the priority listing is updated annually. The optimum season for collecting lake data is mid to late summer, or during peak biological production. Unfortunately, this cannot always be achieved, thus spring or autumnal data have to be used in the lake classification system.

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APPROVED BY: Daniel Carter, State Purchasing Agent

The limits used for awarding severity points for the six parameters have been based on several considerations and information sources. These include lake classifications of other states, the natural range of parameters in Massachusetts, limnological texts, and accepted indices of euthrophication reported in the literature. The severity point system has been formulated as follows:

PARAMETER	CONCENTRATION OR DEGREE OF SEVERITY	POINTS
Hypolimnetic dissolved oxygen	≥5.0 mg/l	0
	<5.0-3.0 mg/l	1
	<3.0-1.0 mg/l	2
	<1.0 mg/l	3
Transparency (secchi disc reading)*	≥15 feet (4.6 meters)	0
	<15-10 feet (4.6-3.0 meters)	1
	<10-4 feet (3.0-1.2 meters)	2
	<4 feet (1.2 meters)	3
Phytoplankton	0-500 cells/ml	0
	>500-1000 cells/ml	1
	>1000-1500 cells/ml	2
	>1500 cells/ml or summer "blooms"	3
Epilimnetic NH_3 + NO_3-N	0-<0.15 mg/l	0
	≥0.15-0.3 mg/l	1
	>0.3-0.5 mg/l	2
	>0.5 mg/l	3
Epilimnetic total phosphorus	0-0.01 mg/l	0
	>0.01-0.05 mg/l	1
	>0.05-0.10 mg/l	2
	>0.10 mg/l	3
Aquatic Vegetation	Sparse	0
	Medium	1
	Dense	2
	Very Dense	3

It is expected that chlorophyll-a data will soon augment or replace the phytoplankton data as they become part of the routine lake survey. The severity points may be interpreted as follows:

0 = No problem. Considered to be representative of clean water quality.

1 = Slight problem; borderline case considered to be potentially degrading.

2 = Definite problem. Considered unacceptable for lake water quality.

3 = Severe problem, undoubtedly causing degradation of the lake's water quality or some recreational uses.

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* Four feet is the minimum allowable transparency at bathing beaches, as stated in Article VII of the State Sanitary Code.

CLASSIFIED LAKES AND PONDS

S = Stratified
U = Unstratified

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Aldrich Lake	66	Granby	Connecticut	S	12	1981
Althea Lake	38	Tyngsborough	Merrimack	S	11	1979
Ames Pond	82	Tewksbury	Shawsheen	U	7	1974
Arcadia Lake	40	Belchertown	Connecticut	U	6	1978
Lake Archer	79	Wrentham	Charles	S	9	1978
Ashfield Pond	39	Ashfield	Deerfield	S	8	1983
Ashland Reservoir	155	Ashland	Concord	S	5	1981
Ashmere Lake	217	Hinsdale/Peru	Housatonic	U	5	1983
Ashumet Pond	203	Mashpee	Cape Cod	S	7	1980
Lake Attitash	335	Amesbury/ Merrimac	Merrimack	S	8	1985
Attleboro Gravel Pit #1	-	Attleboro	Ten Mile	U	4	1981
Attleboro Gravel Pit #2	-	Attleboro	Ten Mile	U	3	1981
Augmentation Pond	333	Westborough	Concord	S	14	1979
Babson Farm Quarry	-	Rockport	North Shore	S	10	1981

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Baddacook Pond	76	Groton	Nashua	S	7	1977
Baker Pond	28	Orleans	Cape Cod	S	5	1980
Baldpate Pond	55	Boxford	Parker	S	10	1981
Bare Hill Pond	316	Harvard	Nashua	U	11	1983
Barrett Pond	8	Leominster	Nashua	S	9	1984
Barrowsville Pond	38	Norton	Taunton	U	13	1983
Bartholomew Pond	8	Peabody	North Shore	S	6	1983
Bartlett Pond	45	Northborough	Concord	U	7	1982
Bearse Pond	65	Barnstable	Cape Cod	U	5	1983
Beaver Lake	149	Ware	Chicopee	U	5	1974
Beaver Pond	14	Beverly	Ipswich	U	11	1984
Bell Pond	7	Worcester	Blackstone	U	6	1979
Bemis Pond	14	Hubbardston	Chicopee	U	10	1979
Benton Pond	63	Otis	Farmington	U	2	1979
Bent's Pond	9	Gardner	Millers	U	11	1979
Berkshire Pond	22	Lanesborough	Hoosic	U	11	1981
Big Alum Lake	189	Sturbridge	Quinebaug	S	8	1980

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Big Bearhole Pond	37	Taunton	Taunton	U	8	1983
Big Pond	331	Otis	Farmington	S	10	1979
Black's Nook	-	Cambridge	Mystic	U	12	1983
Bloody Pond	94	Plymouth	South Shore	S	5	1984
Boons Pond	175	Hudson/Stow	Concord	S	11	1980
Bower Springs Conservation Area	2	Bolton	Nashua	U	8	1979
Box Pond	46	Bellingham	Charles	U	18	1985
Brierly Pond	18	Millbury	Blackstone	U	9	1979
Brigham Pond	45	Hubbardston	Chicopee	U	13	1979
Brockton Reservoir	89	Avon	Taunton	S	8	1975
Brooks Pond	190	Spencer/Oakham N. Braintree/ N. Brookfield	Chicopee	S	7	1983
Browns Pond	26	Peabody	North Shore	S	7	1983
Buck Pond	25	Westfield	Westfield	S	11	1978
Buckley-Dunton Lake	195	Becket	Westfield	U	7	1978
Bullough's Pond	6	Newton	Charles	U	12	1984
Burr's Pond	5	Seekonk	Taunton	S	15	1983

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Lake Buel	194	Monterey/New Marlborough	Housatonic	S	10	1976
Buffumville Reservoir	186	Charlton/Oxford	French	S	3	1976
Buttonwood Park Pond	12	New Bedford	Buzzards Bay	U	9	1984
Camp Putnam Pond	-	New Braintree	Chicopee	U	4	1976
Candlelight Pond	8	Templeton	Millers	U	6	1979
Card Pond	12	W. Stockbridge	Housatonic	U	4	1978
Carding Mill Pond	40	Sudbury	Concord	U	13	1979
Cedar Pond	21	Falmouth	Cape Cod	U	4	1980
Cedar Pond	146	Sturbridge	Quinebaug	U	8	1981
Center Pond	125	Becket	Westfield	S	5	1978
Center Pond	30	Dalton	Housatonic	U	5	1976
Central Pond	139	E. Providence, R.I.	Ten Mile	U	13	1984
Chaffin's Pond	104	Holden	Nashua	U	5	1977
Chandler Pond	11	Brighton	Charles	U	14	1983
Chartley Pond	38	Norton/Attleboro	Taunton	U	13	1980
Chase Pond	-	Fall River	Mount Hope Bay	U	13	1983

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Chauncy Lake	177	Westborough	Concord	S	6	1974
Chebacco Lake	209	Hamilton/Essex	North Shore	S	10	1980
Cheshire Reservoir	418	Cheshire/ Lanesborough	Hoosic	U	7	1980
Chicopee Falls Impoundment	-	Chicopee	Chicopee	U	11	1980
Choate Park Pond	-	Medway	Charles	U	15	1984
Clapps Pond	40	Provincetown	Cape Cod	U	12	1980
Clara Barton Pond	-	Oxford	French	S	9	1982
Clark Pond	6	Walpole	Neponset	U	10	1984
Cleveland Pond	88	Abington	Taunton	U	12	1980
Cliff Pond	193	Brewster	Cape Cod	S	7	1980
Cobb's Pond	24	Walpole	Neponset	S	9	1984
Lake Cochituate (Carling, Middle, North Basins)	361	Framingham/ Natick/Wayland	Concord	S	12	1980
Lake Cochituate (South Basin)	233	Natick	Concord	S	10	1980
Coes Reservoir	90	Worcester	Blackstone	U	10	1977
Comins Pond	-	Warren	Quinebaug	U	5	1983

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Congamond Lakes (Middle)	267	Southwick	Westfield	S	13	1978
Congamond Lakes (North)	48	Southwick	Westfield	S	12	1978
Congamond Lakes (South)	135	Southwick	Westfield	S	13	1978
Cook Pond	154	Fall River	Mount Hope Bay	S	12	1983
Cook Pond	20	Worcester	Blackstone	U	9	1977
Cooley Lake	91	Granville	Westfield	U	8	1979
Cow Pond	38	Groton	Nashua	S	7	1979
Coy Pond	25	Wenham	North Shore	U	9	1983
Crackrock Pond	14	Foxborough	Neponset	U	13	1984
Cranberry Pond	5	Braintree	Weymouth & Weir	U	7	1981
Cranberry Pond	8	Tolland	Farmington	S	8	1979
Cranberry Meadow Pond	63	Spencer/Charlton	Chicopee	U	4	1984
Crystal Lake	90	Douglas	Blackstone	U	8	1977
Crystal Lake	36	Orleans	Cape Cod	S	7	1982
Curtis Pond	18	Worcester	Blackstone	U	10	1985
Damon Pond	88	Chesterfield/ Goshen	Westfield	U	9	1980

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Dark Brook Reservoir	57	Auburn	Blackstone	U	10	1982
Davenport Pond	-	Athol/Petersham	Chicopee	U	9	1982
Davidson Park Pond	-	Winchester	Mystic	U	10	1985
Dean Pond	12	Brimfield/Monson	Chicopee	S	9	1984
Lake Dennison	82	Winchendon	Millers	U	9	1984
Depot (Long) Pond	25	Eastham	Cape Cod	S	2	1980
Diamond International Impoundment	105	Palmer	Chicopee	U	13	1985
Dimmock Pond	11	Springfield	Connecticut	U	8	1978
Dodgeville Pond	47	Attleboro	Ten Mile	U	11	1984
Dorothy Pond	148	Millbury	Blackstone	U	9	1977
Dudley Pond	84	Wayland	Concord	S	5	1979
Dug Pond	48	Natick	Charles	S	5	1985
Dunn's Pond	18	Gardner	Millers	S	4	1985
Eagle Lake	84	Holden	Nashua	U	6	1980
Lake Rohunta (Eagleville Pond)	250	Athol/Orange/ New Salem	Millers	S	10	1981
Eames Pond	74	Paxton	Chicopee	S	8	1984

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
East Brimfield Reservoir	420	Brimfield/ Sturbridge	Quinebaug	U	7	1976
East Indies Pond	69	New Marlborough	Housatonic	U	3	1978
East Lake Waushacum	188	Sterling	Nashua	S	4	1984
Echo Lake	123	Hopkinton	Charles	S	3	1978
Eddy Pond	134	Auburn	Blackstone	U	8	1977
Ell Pond	23	Melrose	Mystic	S	10	1981
Lake Elizabeth	7	Barnstable	Cape Cod	U	11	1982
Lake Ellis	67	Athol	Millers	U	9	1979
Evergreen Cemetary Pond	1	Medway	Charles	U	10	1985
Factory Pond	45	Hanover/Hanson	South Shore	U	12	1980
Falls Pond	60	N. Attleborough	Ten Mile	S	14	1984
Farm Pond	124	Sherborn	Charles	S	6	1983
Farmers Pond	9	Attleboro	Ten Mile	U	14	1984
Fawn Lake	11.5	Bedford	Shawsheen	U	7	1985
Five Mile Pond	36	Springfield	Chicopee	S	6	1978
Flannagan (Fletcher) Pond	87	Ayer	Nashua	U	13	1980

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Flax Pond	27	Bourne	Cape Cod	U	5	1980
Flax Pond	15	Dennis	Cape Cod	S	1	1980
Flax Pond	71	Lynn	North Shore	S	13	1982
Flint Pond (North & South)	297	Grafton/ Shrewsbury	Blackstone	U	9	1977
Flint Pond	61	Tyngsborough	Merrimack	U	7	1985
Floating Bridge Pond	8	Lynn	North Shore	U	11	1982
Flushing Pond	18	Westford	Merrimack	S	7	1974
Forest Lake	55	Methuen	Merrimack	S	7	1981
Forge Pond	68	Granby	Connecticut	U	12	1981
Forge Pond	20	Hanover	South Shore	U	16	1980
Forge Pond	198	Westford/ Littleton	Merrimack	S	11	1974
Fort Meadow Reservoir	284	Hudson/ Marlborough	Concord	S	9	1979
Fort Pond	78	Lancaster	Nashua	S	9	1977
Fort Pond	100	Littleton	Concord	S	10	1980
Fosters Pond	135	Andover/ Wilmington	Shawsheen	S	12	1974

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Foundry Pond	8	Hingham	Weymouth & Weir	U	12	1985
Fresh Pond	29	Dennis	Cape Cod	U	7	1980
Fresh Pond	62	Plymouth	South Shore	S	9	1985
Frye Pond	7	Haverhill	Merrimack	U	7	1983
Fuller Pond	4	Plainville	Ten Mile	U	10	1978
Furnace Pond	100	Pembroke	Taunton	U	6	1980
Gallows Pond	43	Plymouth	Buzzards Bay	S	6	1984
Lake Garfield	262	Monterey	Housatonic	S	9	1976
Lake George	93	Wales	Quinebaug	S	8	1976
Glen Charlie Pond	185	Wareham	South Shore	U	5	1985
Glen Echo Lake	116	Charlton	French	S	11	1984
Goodrich Pond	13	Pittsfield	Housatonic	S	14	1978
Goose Pond	38	Chatham	Cape Cod	S	5	1980
Goose Pond	225	Lee/Tyringham	Housatonic	S	2	1976
Gore Pond	169	Charlton/Dudley	French	S	12	1984
Granite Reservoir	198	Charlton	French	U	4	1974
Graves Brook Reservoir (North)	-	Palmer	Chicopee	S	4	1984

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Graves Brook Reservoir (South)	-	Palmer	Chicopee	S	6	1984
Great Herring Pond	170	Plymouth	South Shore	S	9	1981
Great Pond	109	Eastham	Cape Cod	S	7	1982
Green Hill Pond	32	Worcester	Blackstone	U	7	1977
Green's Pond	10	Fitchburg	Nashua	U	11	1979
Greenville Pond	30	Leicester	French	S	10	1974
Greenwater Pond	88	Becket	Housatonic	S	3	1978
Gristmill Pond	16	Sudbury	Concord	U	15	1979
Griswold Pond	13	Saugus	North Shore	U	7	1985
Grove Pond	67	Ayer	Nashua	S	11	1984
Gull Pond	109	Wellfleet	Cape Cod	S	5	1980
Hager Pond	28	Marlborough	Concord	U	12	1979
Halfway Pond	232	Plymouth	South Shore	U	7	1984
Halls Pond	2	Brookline	Charles	S	13	1983
Hamblins Pond	149	Barnstable	Cape Cod	S	10	1985
Hammond Pond	37	Goshen	Westfield	U	10	1978
Harbor Pond	42	Townsend	Nashua	S	8	1984

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Hardwick Pond	68	Hardwick	Chicopee	S	13	1981
Hardy Pond	41	Waltham	Charles	U	12	1978
Harris Pond	12	Ludlow	Chicopee	U	11	1979
Haviland Pond	25	Ludlow	Chicopee	S	7	1979
Hayden Pond	41	Dudley	French	S	1	1976
Heart Pond	91	Chelmsford	Concord	S	7	1979
Hebronville Pond	16	Attleboro	Ten Mile	U	12	1984
Herring Pond	43	Eastham	Cape Cod	S	9	1979
Highland Lake	15	Norfolk	Charles	S	14	1978
Hills Pond	-	Arlington	Mystic	U	8	1983
Hinckley Pond	171	Harwich	Cape Cod	S	8	1980
Hobart Pond	15	Whitman	Taunton	U	14	1981
Hobomock Pond	15	Pembroke	South Shore	U	10	1985
Hocomonco Pond	27	Westborough	Concord	U	8	1974
Lake Holbrook	32	Holbrook	Weymouth & Weir	U	12	1983
Holland Lake	12	Belchertown	Connecticut	S	8	1978
Holland Reservoir	65	Holland	Quinebaug	S	5	1976

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Hood Pond	67	Topsfield/Ipswich	Ipswich	S	6	1979
Hoosicwhisick Pond	23	Milton	Weymouth & Weir	S	8	1985
Horn Pond	104	Woburn	Mystic	S	10	1983
Horse Pond	30	Westfield	Westfield	U	5	1978
Houghton's Pond	17	Holliston	Charles	U	13	1978
Howe Pond	11	Spencer	Chicopee	S	8	1984
Hoxie Pond	9	Sandwich	Cape Cod	S	11	1980
Ice House Pond	-	Shirley	Nashua	U	8	1982
Indian Lake	190	Worcester	Blackstone	S	9	1976
Island Grove Pond	38	Abington	Taunton	U	13	1983
Jacobs Pond	59	Norwell	South Shore	U	8	1979
Jennings Pond	10	Natick	Charles	U	12	1982
John's Pond	317	Mashpee	Cape Cod	S	10	1980
Johnson's Pond	180	Groveland/Boxford	Merrimack	S	6	1983
Jordan Pond	20	Shrewsbury	Blackstone	U	11	1977
Judkins Pond	6	Winchester	Mystic	U	9	1985
Kendall Pond	23	Gardner	Millers	S	7	1985

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Keyes Pond	40	Westford	Merrimack	S	9	1974
Lackey Pond	117	Uxbridge/ Northbridge	Blackstone	U	12	1977
Lagoon Pond	535	Oak Bluffs/ Tisbury	Islands	U	5	1983
Lake Lashaway	270	East Brookfield/ North Brookfield	Chicopee	S	8	1980
Laurel Lake	51	Erving	Millers	S	6	1985
Laurel Lake	165	Lee/Lenox	Housatonic	S	8	1976
Leach Pond	102	Easton/Sharon	Taunton	U	7	1984
Leadmine Pond	62	Sturbridge	Quinebaug	S	2	1976
Leverett Pond	7	Brookline	Charles	U	9	1978
Leverett Pond	65	Leverett	Connecticut	U	6	1978
Little Pond	16	Bolton	Concord	U	2	1979
Little Alum Pond	73	Brimfield	Quinebaug	S	3	1976
Little Fresh Pond	-	Cambridge	Mystic	U	9	1983
Little Long Pond	45	Plymouth	Buzzards Bay	U	6	1984
Little Nugget Lake	14	Charlton	French	S	8	1984
Little Sandy Bottom Pond	62	Pembroke	South Shore	U	7	1985

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Long Pond	44	Ayer	Nashua	S	12	1984
Long Pond	88	Littleton	Concord	S	8	1979
Long Pond	50	Barnstable	Cape Cod	U	7	1983
Long Pond	163	Dracut/ Tyngsborough	Merrimack	U	8	1983
Long Pond	211	Plymouth	Buzzards Bay	S	6	1984
Long Pond	13	Springfield	Connecticut	U	8	1978
Long Pond	34	Wellfleet	Cape Cod	S	2	1980
Long Sought-for Pond	106	Westford	Merrimack	S	6	1974
Loon Pond	29	Springfield	Connecticut	U	6	1978
Lost Pond	2	Brookline	Charles	U	12	1978
Lost Lake/Knops Pond	204	Groton	Nashua	S	7	1978
Lake Lorraine	27	Springfield	Chicopee	S	7	1978
Louisa Lake	19	Milford	Charles	U	8	1985
Lout Pond	18	Plymouth	South Shore	S	4	1985
Lowe Pond	32	Boxford	Ipswich	U	5	1978
Lower Ashworth Pond (Sibley Pond - South)	19	Charlton	Quinebaug	S	12	1984

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Lower College Pond	6	South Hadley	Connecticut	S	5	1984
Lower Highland Lake	88	Goshen	Connecticut	U	2	1985
Lower Mill Pond	32	Easthampton	Connecticut	U	10	1978
Lower Mystic Lake	111	Arlington/Medford	Mystic	S	15	1978
Lower Naukeag Lake	260	Ashburnham	Millers	U	6	1979
Lower Pond	19	Saugus	North Shore	U	8	1985
Manchaug Pond	348	Douglas/Sutton	Blackstone	S	3	1977
Maquan Pond	45	Hanson	South Shore	U	7	1982
Mare Pond	14	Plymouth	South Shore	U	5	1982
Martins Pond	92	North Reading	Ipswich	U	10	1981
Mascuppic Lake	209	Dracut/ Tyngsborough	Merrimack	S	14	1981
Mashpee/Wakeby Pond	729	Mashpee	Cape Cod	S	9	1980
Massapoag Pond	353	Sharon	Neponset	S	7	1977
Lake Mattawa	112	Orange	Chicopee	S	5	1976
McTaggart's Pond	9	Fitchburg	Nashua	U	7	1979
Mechanics Pond	9	Attleboro	Ten Mile	U	14	1984
Memorial Park Pond	-	Taunton	Taunton	U	13	1983

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Merino Pond	72	Dudley	French	U	2	1976
Metacomet Lake	74	Belchertown	Connecticut	U	7	1978
Mill Pond	34	Littleton	Merrimack	U	12	1974
Mill Pond	17	West Newbury	Merrimack	S	11	1983
Mill Pond	2	Winchester	Mystic	U	8	1985
Minechoag Pond	21	Ludlow	Chicopee	U	9	1979
Mirror Lake	7	Fitchburg	Nashua	U	8	1979
Mirror Lake	55	Wrentham/Norfolk	Charles	U	10	1978
Mona Lake	-	Springfield	Connecticut	U	13	1978
Lake Monomonac	592	Winchendon/ Rindge, NH	Millers	U	7	1976
Monponsett Pond (East)	246	Halifax	Taunton	U	7	1982
Monponsett Pond (West)	282	Halifax	Taunton	U	13	1982
Moore's Pond	31	Warwick	Millers	U	4	1979
Morses Pond	116	Wellesley/Natick	Charles	S	12	1983
Mossy Pond	28	Clinton	Nashua	S	8	1977
Mumford River Impoundment	9	Douglas	Blackstone	U	6	1984

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Murphy Pond	8	Ludlow	Chicopee	U	10	1982
Musquashcut Pond	71	Scituate	South Shore	U	12	1983
Nabnasset Pond	115	Westford	Merrimack	U	7	1977
Nashawannuck Pond	22	Easthampton	Connecticut	S	11	1981
New Long Pond	23	Plymouth	Buzzards Bay	U	9	1984
Nine Mile Pond	32	Wilbraham	Connecticut	S	10	1978
Nipmuc Pond	85	Mendon	Blackstone	S	6	1977
Nippenicket Lake	354	Bridgewater	Taunton	U	7	1975
Noannet Pond	58	Westwood/Dover	Charles	U	5	1985
Lake Noquochoke	124	Dartmouth	Buzzards Bay	S	13	1979
North Spectacle Pond	30	New Salem	Millers	S	9	1979
North Watuppa Pond	1700	Fall River/ Westport	Mount Hope Bay	U	2	1980
Norton Reservoir	529	Mansfield/Norton	Taunton	U	10	1976
Norwich Pond	122	Huntington	Westfield	S	9	1978
Noyes Pond	166	Tolland	Farmington	U	3	1979
Nutting Lake	78	Billerica	Concord	U	14	1985
Oldham Pond	235	Pembroke	South Shore	U	6	1980

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Onota Lake	617	Pittsfield	Housatonic	S	4	1976
Orange Impoundment	-	Orange	Millers	U	14	1981
Otis Reservoir	1200	Otis	Farmington	S	5	1979
The Oxbow	212	Northampton	Connecticut	U	16	1978
Packard Pond	34	Orange	Millers	S	7	1979
Partridge Pond	23	Westminster	Nashua	U	9	1979
Patridgeville Pond	39	Templeton	Millers	U	6	1979
Parker Pond	26	Gardner	Millers	U	7	1979
Patch Pond	3	Worcester	Blackstone	U	8	1979
Lake Pearl	218	Wrentham	Charles	S	12	1983
Pelham Lake	71	Rowe	Deerfield	U	10	1977
Pentucket Pond	85	Georgetown	Parker	S	11	1983
Pepperell Pond	-	Pepperell	Nashua	U	15	1981
Pequot Pond	154	Westfield	Westfield	S	4	1978
Peter's Pond	77	Dracut	Merrimack	S	11	1979
Pierpoint Meadow Pond	90	Charlton/Dudley	French	U	7	1983
Pilgrim Lake	39	Orleans	Cape Cod	S	5	1980

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Pillings Pond	96	Lynnfield	North Shore	U	13	1977
Plainfield Pond	57	Plainfield	Deerfield	U	3	1977
Plunkett Reservoir	73	Hinsdale	Housatonic	S	3	1976
Pondville Pond	41	Auburn/Millbury	Blackstone	U	11	1977
Pontoosuc Lake	480	Pittsfield/ Lanesborough	Housatonic	S	11	1976
Populatic Pond	40	Norfolk	Charles	U	11	1981
Porter Lake	28	Springfield	Connecticut	U	15	1979
Powisett Pond	6	Westwood/Dover	Charles	U	8	1985
Prospect Lake	55	Egremont	Housatonic	U	6	1985
Putnam Pond	4	Fitchburg	Nashua	U	10	1979
Quaboag Pond	531	Brookfield/ East Brookfield	Chicopee	U	8	1980
Quacumquasit Pond	218	Brookfield/ East Brookfield Sturbridge	Chicopee	S	6	1975
Queen Lake	138	Phillipston	Chicopee	U	1	1979
Queen Sewell Pond	18	Bourne	Cape Cod	U	2	1980
Lake Quinsigamond	475	Worcester/ Shrewsbury	Blackstone	S	11	1980

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Ramshorn Pond	117	Millbury/Sutton	Blackstone	S	3	1977
Red Bridge Impoundment	83	Ludlow/Wilbraham/ Palmer	Chicopee	S	9	1985
Red Lily Pond	4	Barnstable	Cape Cod	U	12	1982
Rice City Pond	91	Uxbridge	Blackstone	U	15	1985
Richmond Pond	218	Pittsfield/ Richmond	Housatonic	S	5	1976
Riverdale Pond	18+	Northbridge	Blackstone	S	13	1985
Robbins Pond	124	Bridgewater	Taunton	U	5	1975
Robinson Pond	98	Oxford	French	U	4	1976
Rock Pond	42	Georgetown	Parker	S	12	1983
Rockwell Pond	10	Leominster	Nashua	U	8	1977
Rocky Pond	60	Boylston	Concord	S	2	1974
Rosemary Lake	12	Needham	Charles	U	10	1979
Round Pond		Plymouth	Buzzards Bay	U	5	1984
Rubber Thread Pond	-	Easthampton	Connecticut	U	11	1978
Rudd Pond	80	Becket	Westfield	S	6	1978
Ruggles Pond	19	Wendell	Millers	U	9	1984
Russell Pond	85	Russell	Westfield	S	8	1978

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Lake Sabbatia	237	Taunton	Taunton	S	11	1980
Salisbury Pond	17	Worcester	Blackstone	U	16	1983
Salt Pond*	62	Falmouth	Cape Cod	S	12	1980
Lake Samoset	44	Leominster	Nashua	S	8	1983
Sandy Pond	74	Ayer	Nashua	S	6	1980
Santuit Pond	172	Mashpee	Cape Cod	U	11	1980
Sargent Pond	2	Brookline	Charles	U	10	1982
Sargents Pond	69	Leicester	French	U	6	1978
Sawdy Pond	363	Westport/ Tiverton/ Fall River	Mount Hope Bay	U	3	1983
Sawmill Pond	61	Fitchburg	Nashua	U	14	1981
Sassaquin Pond	34	Acushnet	Buzzards Bay	S	5	1980
Scargo Pond	53	Dennis	Cape Cod	S	5	1982
School Pond	-	Boston	Charles	U	11	1981

* Tidal Pond
\+ New dam has increased area

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Schoolhouse Pond	21	Chatham	Cape Cod	S	2	1980
Seth's Pond	11	West Tisbury	Islands	U	3	1983
Shaker Mill Pond	6	West Stockbridge	Housatonic	U	4	1978
Shallow Pond	67	Barnstable	Cape Cod	U	8	1983
Shaw Pond	100	Becket/Otis	Farmington	S	5	1974
Sheep Pond	148	Brewster	Cape Cod	S	4	1980
Sherman Pond	86	Brimfield	Quinebaug	S	8	1985
Sherman Reservoir	162	Monroe/Rowe/ Whitingham, VT	Deerfield	S	4	1977
Lake Shirley	376	Lunenburg/ Shirley	Nashua	S	11	1977
Shubael Pond	56	Barnstable	Cape Cod	S	6	1980
Silver Lake	10	Agawam	Connecticut	S	13	1982
Silver Lake	70	Bellingham	Blackstone	U	7	1978
Silver Lake	23	Grafton	Blackstone	U	10	1980
Silver Lake	28	Wilmington	Ipswich	S	9	1984
Singing Dam Pond	-	Sutton	Blackstone	U	16	1985
Singletary Pond	330	Millbury/Sutton	Blackstone	S	8	1985

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Slater's Pond	107	Oxford	French	S	4	1976
Sluice Pond	50	Lynn	North Shore	S	10	1981
Snake Pond	83	Sandwich	Cape Cod	U	3	1980
Snow's Mill Pond	35	Fitchburg	Nashua	U	6	1981
Spectacle Pond	70	Lancaster	Nashua	S	4	1977
Sportman's Pond	102	Athol	Millers	U	10	1979
Spring Pond	9	Saugus	North Shore	U	11	1985
Spy Pond	103	Arlington	Mystic	S	16	1981
South Athol Lake	76	Athol	Millers	U	8	1979
South End Pond	30	Millis	Charles	U	9	1983
South Meadow Pond (East)		Clinton	Nashua	S	9	1977
South Meadow Pond (West)	68	Clinton/Lancaster	Nashua	U	9	1977
South Spectacle Pond	37	New Salem	Millers	S	11	1979
South Watuppa Pond	1283	Fall River/ Westport	Mount Hope Bay	U	9	1980
Stearn's Mill Pond	19	Sudbury	Concord	U	12	1979
Stetson Pond	93	Pembroke	Taunton	S	7	1985
Stiles Pond	60	Boxford	Ipswich	S	8	1978

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Stiles Reservoir	346	Leicester/Spencer	French	S	9	1983
Stockbridge Bowl	374	Stockbridge	Housatonic	S	9	1976
Stoneville Reservoir	55	Auburn	Blackstone	U	5	1980
Straits Pond	91	Cohasset/Hull	Weymouth & Weir	U	9	1979
Sugden Reservoir*	83	Spencer	Chicopee	U	4	1981
Sunset Lake	300	Ashburnham	Millers	S	12	1979
Sunset Lake	5	Oak Bluffs	Islands	U	9	1976
Sunset Lake	57	Braintree	Weymouth & Weir	S	8	1979
Ten Mile Reservation	-	Pawtucket, R.I.	Ten Mile	U	15	1984
Terry Brook Reservoir	10	Freetown	Taunton	S	10	1983
Texas Pond	27	Oxford	French	U	9	1974
Thayer Pond	9	Oxford	French	U	13	1983
The Reservoir	7	Harwich	Cape Cod	U	9	1980
Thirty Acre Pond	30	Brockton	Taunton	U	4	1975
Thompson's Pond	117	Spencer	Chicopee	S	7	1984

* (Sampled after dam breached. Under normal conditions, severity points may drop).

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Tinkham Pond	20	Acushnet/ Mattapoisett	Buzzards Bay	U	14	1980
Todd Pond	5	Lincoln	Charles	S	14	1985
Tripps Pond	6	Hudson	Concord	U	8	1982
Tully Pond	32	Orange	Millers	S	7	1979
Turner Pond	55	Dartmouth	Buzzards Bay	U	12	1980
Turner Reservoir	124	E. Providence, RI	Ten Mile	U	11	1984
Turnpike Lake	115	Plainville	Ten Mile	U	6	1979
Uncas Pond	18	Franklin	Charles	S	9	1985
Upper College Pond	11	South Hadley	Connecticut	S	8	1984
Upper Goose Pond	45	Lee/Tyringham	Housatonic	S	4	1976
Upper Highland Lake	53	Goshen	Connecticut	U	4	1985
Upper Mystic Lake	167	Winchester/ Arlington/ Medford	Mystic	S	15	1978
Upton's Pond	7	Tyngsborough	Merrimack	S	11	1979
Van Horn Pond	9	Springfield	Connecticut	S	13	1978
Venture Pond	7	Springfield	Connecticut	U	15	1979

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Village Pond	7	Springfield	Connecticut	U	15	1979
Lake Waban	108	Wellesley	Charles	S	9	1978
Waite Pond	54	Leicester	Blackstone	U	5	1977
Walden Pond	58	Concord	Concord	S	4	1985
Waldo Pond	70	Avon/Brockton	Taunton	U	7	1975
Walker Pond	94	Sturbridge	Quinebaug	U	5	1976
Walker Pond	7	Watertown	Charles	U	9	1978
Wallum Lake	322	Douglas/ Burrillville, RI	Blackstone	S	2	1977
Wampatuck Pond	65	Hanson	Taunton	U	10	1980
Ward Pond	51	Ashburnham	Millers	S	13	1979
Ware Impoundment	-	Ware	Chicopee	S	11	1980
Warner's Pond	54	Concord	Concord	S	10	1974
Warner's Pond	68	Hadley	Connecticut	U	12	1979
Waushacum Pond	81	Ashland/ Framingham	Concord	S	8	1984
Lake Watatic	28	Ashburnham	Millers	U	11	1979
Watershops Pond	157	Springfield	Connecticut	S	10	1978

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Wattles Pond	10	Groton	Nashua	S	10	1979
Webster Lake	1181	Webster	French	S	6	1979
Wedge Pond	21	Winchester	Mystic	S	10	1985
Wequaquet Lake	654	Barnstable	Cape Cod	U	5	1980
Western Mass. Electric Impoundment	-	Ludlow/Wilbraham	Chicopee	S	8	1980
West Pond	19	Bolton	Concord	S	8	1979
West Waushacum Pond	112	Sterling	Nashua	S	7	1977
Wetherells Pond	13	Plainville	Ten Mile	U	14	1984
Whalom Pond	99	Leominster/ Lunenburg	Nashua	S	6	1977
Wheeler's Pond	22	Erving	Millers	U	7	1979
Whitehall Pond	-	Rutland	Chicopee	S	5	1984
Whitehall Reservoir	575	Hopkinton	Concord	S	9	1983
White Pond	67	Athol	Millers	S	10	1979
White Pond	43	Concord	Concord	S	5	1979
White Pond	43	Lancaster	Nashua	U	7	1979
White Island pond	294	Plymouth/Wareham	Buzzards Bay	S	13	1985

Lakes and Ponds (Continued)

LAKE/POND	AREA (ACRES)	LOCATION	DRAINAGE BASIN	STRATI-FICATION	SEVERITY POINTS	DATE SURVEYED
Whitman's Pond	210	Weymouth	Weymouth & Weir	S	10	1981
Whitney Pond	107	Winchendon	Millers	S	10	1979
Wickaboag Pond	320	W. Brookfield	Chicopee	U	10	1985
Willow Lake	4	Northampton	Connecticut	U	6	1982
Willow Pond	1	Brookline	Charles	U	7	1978
Windsor Pond	44	Windsor	Westfield	S	8	1978
Winning Pond	23	Billerica	Concord	U	9	1979
Winnecunnet Pond	148	Norton	Taunton	U	8	1980
Winnekeag Lake	118	Ashburnham	Nashua	S	10	1980
Winter Pond	17	Winchester	Mystic	U	12	1985
Lake Winthrop	150	Holliston	Charles	S	9	1979
Woods Pond	122	Lenox	Housatonic	U	17	1981
Woods Pond	52	Middleboro	Taunton	U	6	1985
Wyman Pond	200	Westminster	Nashua	S	12	1981
Lake Wyola	129	Shutesbury	Connecticut	S	9	1978
Yokum Pond	109	Becket	Westfield	U	3	1978

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COMMONWEALTH OF MASSACHUSETTS SUMMARY OF WATER QUALITY 1986

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Appendix III - Basin / Segment Information

Massachusetts Department of Environmental Quality Engineering
S. Russell Sylva, Commissioner

DIVISION of WATER POLLUTION CONTROL
Thomas C. McMahon, Director

LIST OF BASINS

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BASIN/SEGMENT INFORMATION

A summary by drainage basin is found in Table 2. Appendix III contains 32 detailed drainage basin summaries. Each synopsis contains a narrative basin description, a water quality conditions and trends description, a bibliography of up-to-date basin reports, a basin map, and a classification table of water quality segments. These appear in alphabetical order with the basin order shown in Figure 2. Each classification table has seven elements that are defined below.

1. Segment Description: A description of the river segment or harbor.

2. River Miles: Inclusive mile points of the segment, where 0.0 is the mouth of the river, or the area of a harbor in square miles.

3. Water Use Classification: See Appendix I.

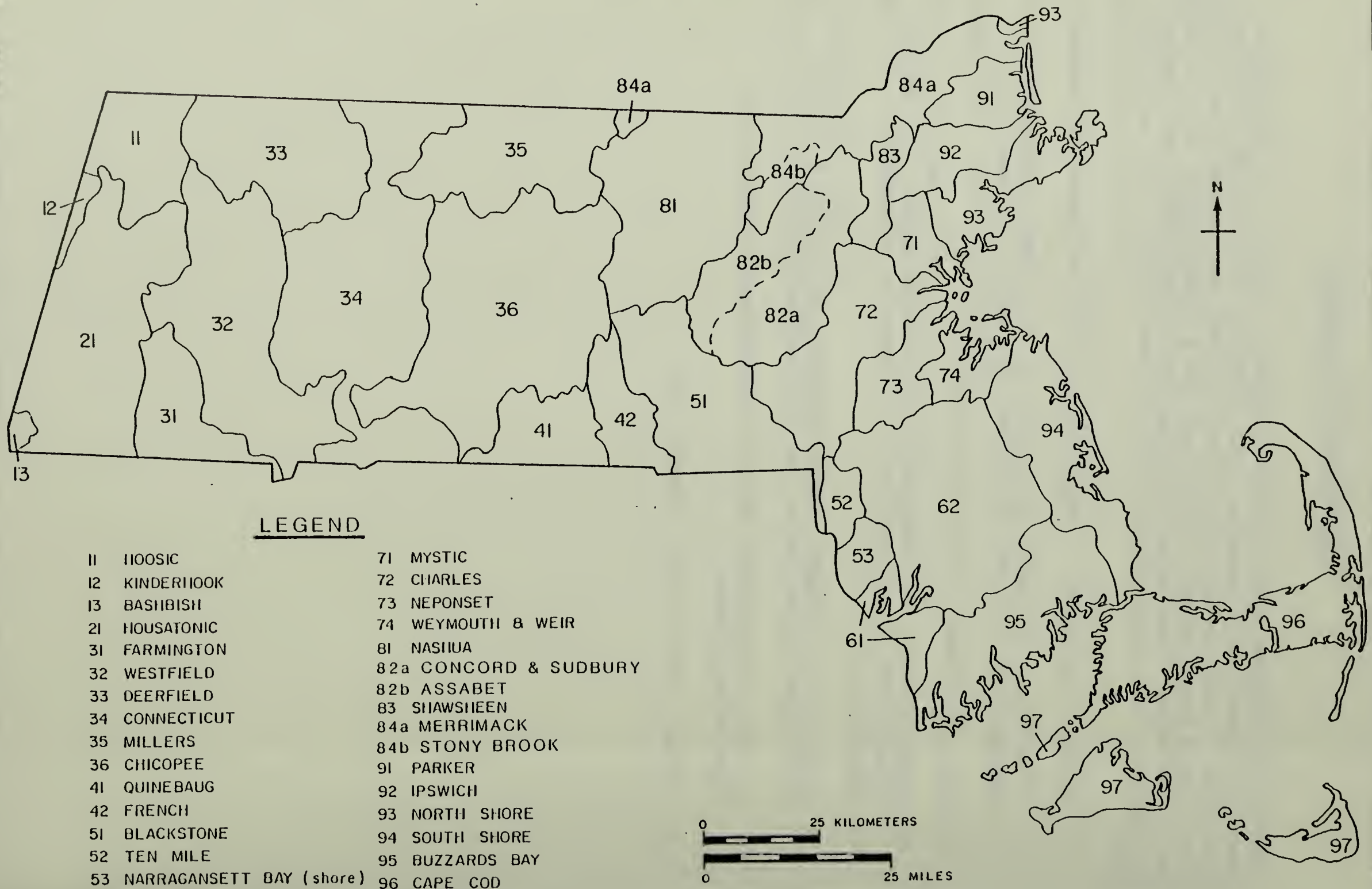
4. Support Status: An indication of the segments support (S), partial support (PS), non-support (NS), or unknown (U) of the water classification.

5. Water Quality Problems: Those parameters which cause a segment not to meet its designated use, or natural conditions.

6. Source(s) of Problems: Natural or anthropogenic inputs which cause noncompliance.

7. Abatement Needs to Meet Classification.

RIVER BASINS and COASTAL DRAINAGE AREAS



LEGEND

11	HOOSIC
12	KINDERHOOK
13	BASHBISH
21	HOUSATONIC
31	FARMINGTON
32	WESTFIELD
33	DEERFIELD
34	CONNECTICUT
35	MILLERS
36	CHICOPEE
41	QUINEBAUG
42	FRENCH
51	BLACKSTONE
52	TEN MILE
53	NARRAGANSETT BAY (shore)
61	MOUNT HOPE BAY (shore)
62	TAUNTON
71	MYSTIC
72	CHARLES
73	NEPONSET
74	WEYMOUTH & WEIR
81	NASHUA
82a	CONCORD & SUDBURY
82b	ASSABET
83	SHAWSHEEN
84a	MERRIMACK
84b	STONY BROOK
91	PARKER
92	IPSWICH
93	NORTH SHORE
94	SOUTH SHORE
95	BUZZARDS BAY
96	CAPE COD
97	ISLANDS

ASSABET RIVER BASIN (82)

Description of the Watershed

The Assabet River has its beginnings in the town of Westborough. It flows northeasterly for 31 miles through the towns of Westborough, Marlborough, Maynard, Hudson and Concord and several others. The Assabet drains an area of 175 square miles. It receives the discharges of five municipal wastewater treatment plants. Because of the number of wastewater discharges and the numerous impoundments along its course, the Assabet River does not meet class B water quality standard conditions.

The United States Geological Survey (USGS) maintains a flow gaging station in Maynard with records dating back to 1941. The average discharge at this gage over 42 years of record is 185 cubic feet per second (cfs) while the seven-day ten-year low flow is 15.1 cfs.

Water Quality Conditions and Trends

Municipal wastewater treatment plant discharges and impoundments continue to plague the Assabet River as they have done for two decades. The only portion of the river meeting class B water quality conditions throughout the year is the first mile starting at the headwaters prior to any wastewater discharges. Sampling programs in 1965, 1969, 1974, 1979 and 1985 all document significant dissolved oxygen deficits and excessive fecal coliform counts. Significant stretches of the river support dense populations of algae and macrophytes during the summer months. Decaying vegetation, sediments in impoundments and slow-moving sections, and anaerobic in-stream conditions have been responsible for odor complaints.

Progress toward the attainment of improved water quality in the Assabet River has been slow but steady since the enactment of the Federal Water Pollution Control Act. Most upgradings of the basin's municipal wastewater treatment plants are scheduled to be completed by late 1986 except Marlborough-West, which is projected to be completed by 1989. Included in the upgradings are the combining of the present Westborough and Shrewsbury discharges into one advanced secondary discharge, the upgrading of the Marlborough-West and Hudson wastewater treatment plants to advanced secondary, and the attainment of reliable secondary treatment at Maynard. No improvements in Assabet River water quality are expected until these upgradings are completed.

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Figure 3

ASSABET RIVER BASIN (82b)

TABLE 13
ASSABET RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Outlet of flow Augmentation Pond, Westborough to Westborough WWTP, Westborough	31.0-30.0	B	PS	D.O.	Natural - due to Augmentation Pond.	Rehabilitation of Augmentation Pond.
Westborough WWTP to Shrewsbury WWTP, Westborough	30.0-29.5	B	NS	D.O., Fecal Coliform Bacteria, Nutrients.	Westborough WWTP.	Upgrading of Westborough WWTP for increased flows and advanced treatment. Expected completion in late 1986.
Shrewsbury WWTP outfall to Route 20 dam, Northborough	29.5-26.5	B	NS	D.O., Fecal Coliform Bacteria, Nutrients, Aesthetics.	Shrewsbury WWTP.	Diversion of Shrewsbury wastewater to new Westborough WWTP; expected completion in late 1986.
Route 20 dam to Marlborough Westerly WWTP, Marlborough	26.5-24.2	B	NS	D.O., Fecal Coliform Bacteria, Nutrients, Aesthetics.	Upstream WWTP's.	Upgrading of WWTP's expected in late 1986.
Marlborough Westerly WWTP to Hudson WWTP, Hudson	24.2-16.3	B	NS	D.O., Fecal Coliform Bacteria, Nutrients.	Marlborough Westerly WWTP.	Upgrading of Marlborough Westerly WWTP for increased flows and ammonia oxidation. Expected completion in

TABLE 13 (CONTINUED)

SEGMENT RIVER

TABLE 13 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Hudson WWTP to outlet of Boons Pond, Stow	16.3-12.3	B	NS	D.O., Fecal Coliform Bacteria, Nutrients.	Hudson WWTP, impoundment, urban runoff.	Upgrading of Hudson WWTP for increased flow and seasonal nitrification. Expected completion in late 1986.
Outlet of Boons Pond to before Maynard WWTP, Maynard	12.3-6.5	B	NS	D.O., Fecal Coliform Bacteria, Nutrients.	Upstream WWTP's urban runoff.	Upgrading of Hudson WWTP. Expected completion in late 1986.
Maynard WWTP to before Concord MCI WWTP, Concord	6.5-2.5	B	NS	D.O., Fecal Coliform Bacteria, Nutrients.	Maynard WWTP.	Upgrading and increasing capacity of Maynard WWTP. Expected completion in mid 1986.
Concord MCI WWTP to confluence with Sudbury River, Concord	2.5-0.0	B	NS	Fecal Coliform Bacteria, Nutrients.	Concord MCI WWTP. Upstream WWTP.	Upgrading of Maynard WWTP. Expected completion in mid 1986. Improved operation or upgrading of Concord MCI WWTP.

Miles Assessed: 31.0
Miles Supporting Classification: 0.0
Miles Partially Supporting Classification: 1.0

BLACKSTONE RIVER BASIN (51)

Description of the Watershed

The Blackstone River is an interstate stream originating in Worcester, Massachusetts and flowing southeast approximately 45 miles to Providence, Rhode Island where it forms the headwaters of Narragansett Bay. Approximately 328 square miles are located in Massachusetts. The headwaters of the river are provided by the Kettle Brook Reservoir system located in Paxton. The Kettle brook flowing in a southeasterly direction is joined by Beaver and Tatnuck brooks to form the Middle River. The Middle River in turn becomes the Blackstone River at the confluence with Mill Brook in Worcester. At this point the river flows approximately 29 miles to the Massachusetts/Rhode Island border. Major tributaries below Worcester that contribute flow to the river include the Quinsigamond River drainage area (37 mi^2), the West River (29.7 mi^2), the Mumford River (58 mi^2) and Mill River (35 mi^2). The total Blackstone drainage basin covers a total area of 540 square miles.

From the headwaters to the state line the river drops 1,010 feet. Over half of this drop occurs within the first 10 miles and much of the rest is taken up by many dams along the river. The U.S. Geological Survey (USGS) maintains flow gaging stations and one water quality station in the Blackstone River Basin. The gaging station in Northbridge on the Blackstone River which drains an area of 139 square miles, had an average flow from October 1939 to September 1976 of 267 cubic feet per second. This gage was discontinued in September 1977. Another gage discontinued in September 1978 was located on Kettle Brook in Worcester. The remaining gages within Massachusetts on the Blackstone River record flows on the Quinsigamond and West Rivers and water quality on the Blackstone River in Millville, Massachusetts. The USGS also maintains a flow gage on the Blackstone River in Woonsocket, Rhode Island just over the state line. The average discharge at this gage over 51 years of record is 758 cubic feet per second and the seven-day ten-year low flow is approximately 100 cfs. The United States Army Corp of Engineers operates one flood control dam on the West River.

Water Quality Conditions and Trends

From the mid 1800's to the late 1960's and early 1970's water quality in the Blackstone River was severely degraded so that it was unfit for any uses other than power generation and waste disposal. Problems included greatly elevated coliform counts, solids and nutrients, and severely depressed dissolved oxygen concentrations. Sections of the Mumford River and Mill River were similarly degraded.

The late 1970's to the present have shown great strides in pollution abatement. A report published by the Division in 1971 listed 58 wastewater discharges to the Blackstone River and its tributaries. This number has been reduced to 16 permitted discharges including five new secondary or advanced wastewater treatment plants in Grafton, Uxbridge, Millbury, Hopedale, and Worcester. A majority of the wastewater discharges have tied into the Upper Blackstone Water Pollution Abatement District with pre-treatment.

Despite these improvements many areas of the river are still not meeting the assigned classifications. Problems start shortly downstream from the outlet of Waite Pond in Leicester. Worcester Spinning and Finishing Company operates a treatment facility to handle their textile process wastes. While their treatment is good, effluent volumes are high compared to stream flow causing color, dissolved oxygen and nutrient problems. These problems are further aggravated by untreated sanitary discharges entering Kettle Brook through storm drains throughout the Cherry Valley section of Leicester. The Cherry Valley Sewer District is presently developing a facilities plan to study and alleviate the water quality problems in this area. Water quality begins to recover and remains at its classification until it reaches Worcester where it receives stormwater runoff and combined sewer overflows from Mill Brook. The overflow from Mill Brook is scheduled to be tied into the Upper Blackstone Water Pollution Abatement District Wastewater Treatment Facility (UBWPAD-WWTF). Excess stormwater flows will be handled by a stormwater detention and chlorination plant scheduled to be on line by 1987. This abatement project was initiated by the Division in 1984 to upgrade the Blackstone River from class C to class B within the segment from the Massachusetts Turnpike to Fisherville Pond, Grafton.

One of the major problems in the Blackstone River is the sheer volume of the UBWPAD-WWTF discharge. During periods of low flow in the summer months the discharge flow is close to or greater than the river flow. While the UBWPAD plant presently produces a good or "polished" secondary effluent or better, the river tends to take on the characteristics of the effluent due to volume. The major impact appears to be deoxygenation caused by large amounts of ammonia nitrogen discharged by the UBWPAD. The recently renewed NPDES discharge permit (Sept. 31, 1985) requires the treatment plant to achieve nitrification or advanced wastewater treatment by 1988. Also many raw sanitary discharges in South Grafton have been tied into the Grafton Wastewater Treatment Facility. Likewise the construction of the Uxbridge WWTP has eliminated discharges in Uxbridge center including the Emil Bernat discharge.

A new area of concern is the toxicity of the sediment below Worcester. Years of waste disposal have created large deposits of sediment from Millbury to Uxbridge. Recent studies have shown these sediments to be laden with cadmium, chromium, nickel, lead, tin, and zinc. (The public health impacts of this condition are not known at the present time. This situation should, however, preclude any primary contact types of recreation until further investigation is conducted.)

For the most part all tributary streams meet their assigned classification. Minor problems on the Mumford River have improved due to the elimination of the discharge from Hayward Schuster. However a company from Maine, Guilford Industries, has purchased this facility and is presently operating at low production volumes. A new NPDES permit has been issued requiring strict water quality based effluent limitations to ensure its B classification is maintained. Water quality problems existed in the Mill River due to the outdated Hopedale WWTP. The completion of a new advanced secondary wastewater treatment facility has corrected these problems.

Many of the tributaries support a wide variety of uses. The headwaters of the Blackstone, Tatnuck and Kettle Brooks, are used as the major source of Worcester's water supply. Most of the tributaries support at least warm water

fisheries and many are stocked trout waters. The West River is used extensively for fishing and also has a recreation area. The U.S. Army Corps of Engineers maintains a dam on this river for the purpose of flood control. The lower portion of the Mill River (Harris Pond) is used as an emergency water supply for the city of Woonsocket, Rhode Island.

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Figure 4 BLACKSTONE RIVER BASIN (51)

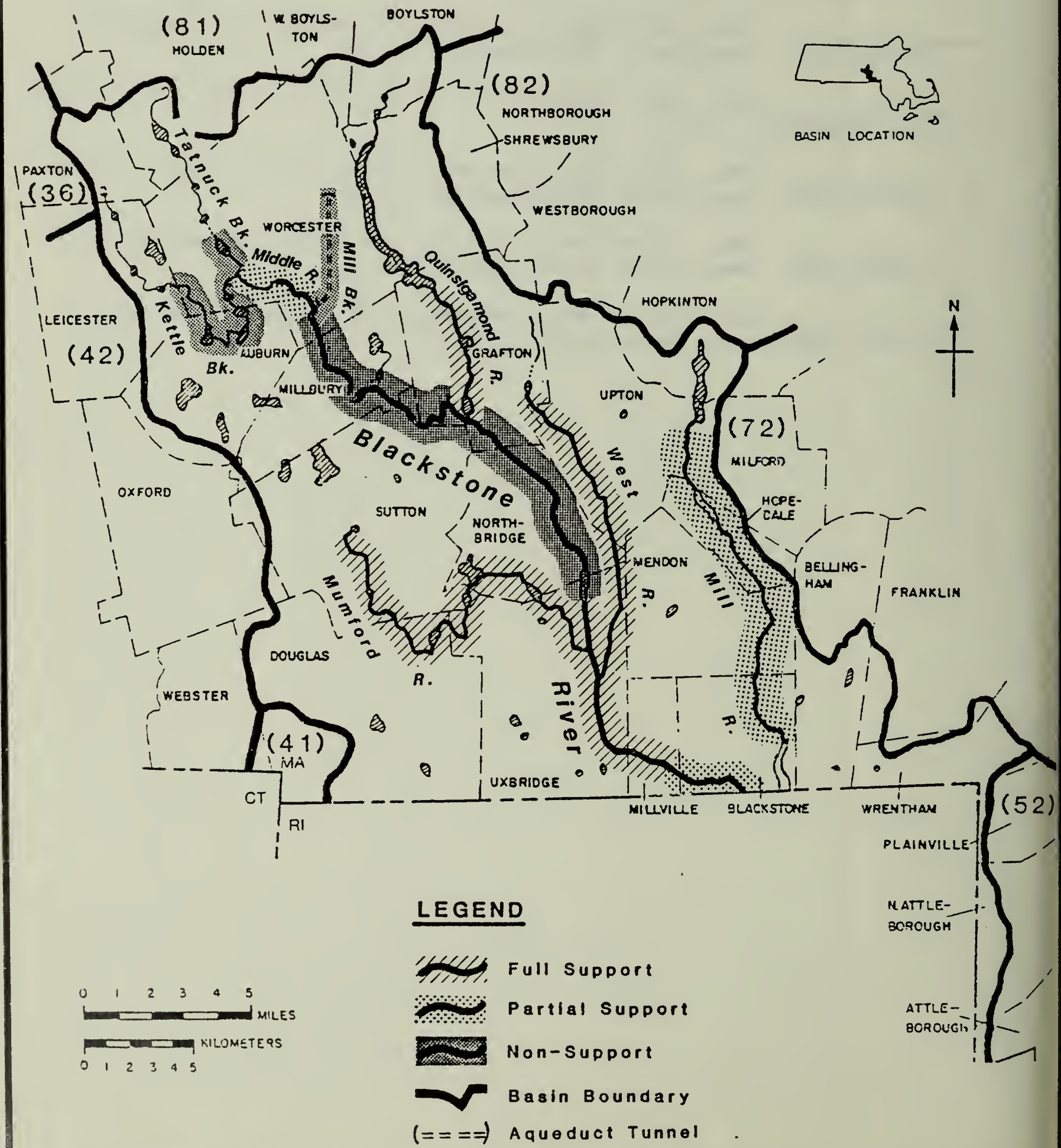

TABLE 14
BLACKSTONE RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Kettle Brook from Waite Pond, Leicester to Curtis Pond, Worcester	59.3 - 51.3	B	NS	Color Coliform Bacteria Nutrients	Worcester Spinning and Finishing	Sewer this area to either UBWPAD WWTP.
Middle River Curtis Pond to American Steel Dam, Worcester	51.3 - 48.8	B	PS	Solids Coliform Bacteria	Urban Runoff	Best management practices (BMP)
American Steel Dam, Worcester, to Fisherville Dam, Grafton	48.8 - 39.8	B	NS	Dissolved Oxygen Solids Coliform Bacteria Nutrients	Mill Brook CSO's. UBWPAD + WWTP	Combined sewer separation project in Worcester by 1987. Upgrading of UBWPAD to AWT by 1988.
Fisherville Dam, Grafton to Rice City Pond, Uxbridge	39.8 - 31.1	B	NS	Dissolved Oxygen Nutrients Algae	UBWPAD + WWTP Nitrification	Upgrading of UBWPAD to AWT by 1988.
Rice City Pond, Uxbridge to Water Quality Monitor, Millville	31.1- 23.7	B	S	--	Sediment in impoundments. --	--
Water Quality Monitor, Millville to Blackstone - Woonsocket, R.I.	23.7 - 20.0	B	PS	Coliform Bacteria. Nutrients	Urban Runoff	Sanitary discharges have recently been tied into.
Mumford River entire length	14.5 - 0.0	B	S	--	--	--
West River entire length	8.8 - 0.0	B	S	--	--	--

TABLE 14 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Mill River entire length	11.0 - 0.0	B	PS	--	Hopedale WWTP was recently upgraded	--
Mill Brook entire length	3.0 - 0.0	B	NS	Dissolved Oxygen Solids Coliform Bacteria pH Nutrients	CSO's	Separate combined sewers, construction to be completed by 1987.
Tatnuck/Beaver Brooks, entire length	3.0 - 0.0	B	NS	Dissolved Oxygen Solids Coliform Bacteria Nutrients	CSO's	Separate combined sewers, construction to be completed by 1987.
Quinsigamond River, entire length	5.3 - 0.0	B	S	--	--	--

Miles Assessed: 84.9 miles
Miles Supporting Classification: 36 miles
Miles Partially Supporting Classification: 17.2 miles

BOSTON HARBOR (70)

Description of the Watershed

Boston Harbor includes areas of Boston, Quincy, Hull and Chelsea. It extends from the Chelsea River, the Charles River Dam, Hingham Bay and the confluence of the Neponset River with Dorchester Bay to a line connecting the Boston Lighthouse to Deer Island in Boston and Point Allerton in Hull. The harbor includes Fort Point Channel, the Chelsea River, Dorchester Bay (2,000 acres). Quincy Bay (11,000 acres), Hingham Bay (4,500 acres) and Hull Bay (1,400 acres). Twenty-two of 28 islands in the Harbor Islands State Park lie within the area described here - roughly 46 square miles.

Boston Harbor receives the drainage, including waste discharges of four major coastal streams - the Mystic, Charles, Neponset and the Weymouth Fore Rivers. It also receives discharges from the entire waterfront and minor tributary areas extending from Winthrop to Hull. The total flow from tributary streams averages 350 cfs during the summer. This flow is very low compared to the daily inflow of salt water during tidal flushing, which averages 320,000 cfs for a six-hour period.

Water Quality Conditions and Trends

Boston Harbor receives the discharge of municipal wastewater from approximately two million people served by the Massachusetts Water Resources Authority (formerly the Metropolitan District Commission) sewerage system. The sewage discharge is roughly 500 million gallons per day. Degradation of the water quality in the harbor also results from industrial waste discharges, about one hundred combined sewer overflows, streams tributary to the harbor, watercraft wastes, debris and refuse contributed by barging operations, shoreline refuse dumping and dilapidated piers and wharves.

Existing water quality data indicate some degree of noncompliance with the applicable salt water quality standards in nearly all segments of the harbor. The major water quality problems include elevated levels of trace metals, coliform bacteria, oil and grease. Dissolved oxygen concentrations are often below the 6.0 mg/l standard. Water quality problems are particularly severe in the inner harbor and, to a lesser degree, in Dorchester and Quincy Bays.

Actions currently being undertaken to abate pollution of the harbor include separation and treatment of combined sewer overflows, and operational maintenance improvements to the Deer and Nut Island sewage treatment plants. A secondary stage treatment plant will be constructed at a cost of approximately 1.1 billion dollars to replace the Deer Island and Nut Island primary sewage treatment plants. Industrial pre-treatment regulations are expected to reduce the discharges of toxic compounds to the Deer Island and the Nut Island treatment plant facilities.

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Figure 5 BOSTON HARBOR BASIN (70)

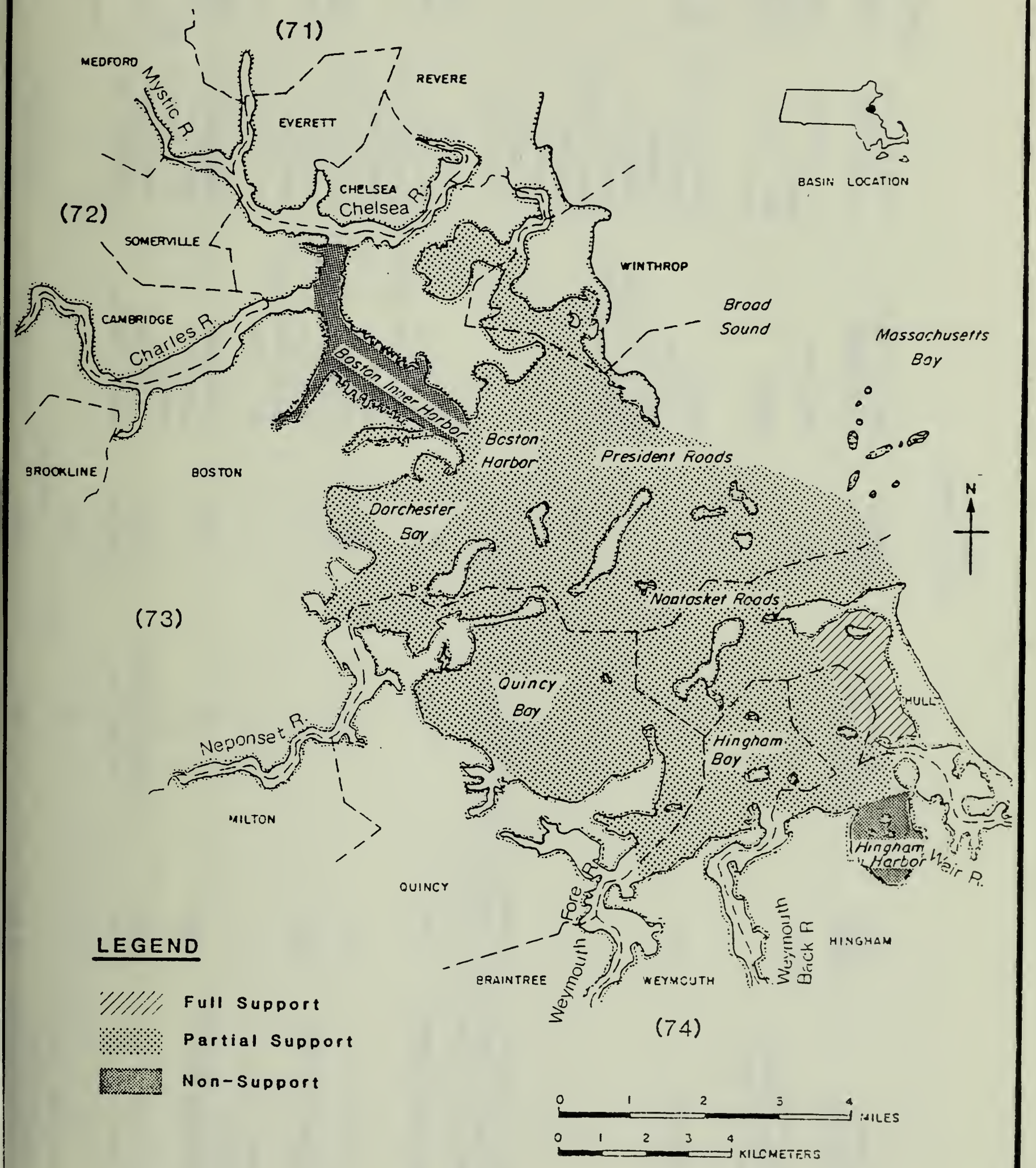

TABLE 15
BOSTON HARBOR

SEGMENT DESCRIPTION	SQUARE MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Outer Harbor President Roads & Nantasket Roads)	24.15	SB	PS	Coliform Metals	Deer Island WWTP. Nut Island WWTP.	Stop sludge dumping. Secondary treatment proposed.
Inner Harbor	2.21	SC	NS	Metals. Coliform. Aesthetics. Oil and grease. Dissolved oxygen.	Combined sewer overflows. In-place sediments. Debris. Water traffic. Nonpoint sources. Tributary pollutants.	CSO treatment proposed.
Fort Point Channel	0.053	SC	NS	Metals. Coliform. Dissolved oxygen.	In-place sediments. Combined sewer overflows.	CSO treatment proposed.
Reserved Channel	0.12	SC	PS	Metals. Bacteria. Dissolved oxygen.	In-place sediments. Combined sewer overflows.	CSO treatment proposed.
Dorchester Bay	3.35	SB	PS	Coliform. Dissolved oxygen. Metals.	Combined sewer overflows. Calf pasture and Moon Island pumping station.	CSO separation and treatment.
Quincy Bay (portion designated SA)	1.0	SA	PS	--	--	--
(excluding portion designated SA)	4.78	SB	PS	Coliform. Debris.	Storm drain discharges. Nut Island WWTP.	O&M correction.

TABLE 15 (CONTINUED)

TABLE 15 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Hingham Bay (excluding Hingham Harbor)	5.98	SB	PS	Metals.	Storm discharges.	CSO treatment.
(Hingham Harbor)	1.0	SA	NS	Coliform.	--	CSO treatment.
Hull Bay	2.18	SB	S	--	--	--
Winthrop Bay	1.49	SB	PS	Coliform. Metals.	Combined sewer overflows.	CSO treatment.

Square Miles Assessed: 46.31 mi^2
Square Miles Supporting Classification: 2.18 mi^2
Square Miles Partially Supporting Classification: 40.87 mi^2

BUZZARDS BAY DRAINAGE BASIN (95)

Description of the Watershed

The Buzzards Bay Basin is formed by seven major coastal river basins which discharge their waters to the Massachusetts coastline from Bourne to Westport. The Cape Cod Canal determines the eastern border of the basin, while the Rhode Island state line defines the western border. From east to west, the major river basins are: Agawam, Wankinco, Weweantic, Mattapoisett, Acushnet, Paskamanset/Slocums, and Westport. The Buzzards Bay Basin has an approximate drainage area of 350 square miles.

Geologically, the Buzzards Bay Basin is characterized as a low granitic upland with glacial till and outwash deposits forming the soils. The terrain can be described as low and gently rolling, with elevations ranging from slightly more than 200 feet in the hilly northernmost portions of the basin to sea level at the coastline. The minimal elevation change in the basin accounts for the meandering nature of most of the rivers.

The straight-line distance of the Buzzards Bay coastline is 32 miles, but its actual total length is 210 miles when all the nonconformities are accounted for. The numerous harbors and coves formed by the jagged coastline are used extensively for recreational and commercial purposes. New Bedford Harbor, which is famous for its whaling history, is the industrial and commercial center of the basin and, in turn, suffers the most severe water quality problems. The problems plaguing other harbors within Buzzards Bay include discharges of sanitary wastes from municipal collection systems and any watercraft. Oil pollution from the on-shore terminals and the offshore tankers is a problem that is common to the entire coastline of Buzzards Bay.

Water Quality Conditions and Trends

The most recent intensive water quality survey conducted in the basin was completed August 1985. During that time 85 monitoring stations were sampled in accordance with established sampling procedures. These stations occupied locations within the major fresh surface rivers, in the intertidal zones, inner embayments and the outer bay. The stations were confined to the drainage basin north of a line drawn between Mattapoisett Harbor on the western shore of the Bay Quissett Harbor on the eastern shore of the Bay in the town of Falmouth (Cape Cod Drainage Basin). Analyses were conducted on a wide range of parameters including dissolved oxygen, pH, nutrients and heavy metals. While data tabulation and interpretation are still underway a preliminary review indicates periodic water degradation in the form of low dissolved oxygen concentrations and elevated coliform levels. Potential sources are natural conditions, urban runoff, boats, faulty septic systems and agricultural runoff. Extensive studies have been underway in the lower portion of the Bay particularly in New Bedford Harbor. Due to the presence of high levels of polychlorinated biphenyls (PCB's) and heavy metals, work is currently being conducted under EPA Superfund money to fully evaluate the extent of the problem and take corrective action. In addition the development of a cooperative Estuarine Management Plan for Buzzards Bay is currently underway. This plan seeks to develop a cooperative approach between government regulatory agencies, research institutions and the public in order to identify and develop a coordinated approach to addressing the basins water quality problems. Currently there are five (5) major wastewater treatment facilities in the basin.

The only significant problem is with the New Bedford WWTP. This facility, which experiences considerable operational and hydraulic overloading problems, has a number of studies and grants underway to improve the facility's and correct the existing CSO problems within the harbor and tie the town of Acushnet into the system. It should also be pointed out that the city has requested a 301(h) waiver from the Division and EPA. The towns of Wareham, Marion, Fairhaven and Dartmouth which contain the remaining municipal waste disposal systems currently have facilities plan reviews to upgrade or expand their respective sewage treatment plants. With the exception of the Acushnet River and New Bedford Harbor area, industrial wastewater discharges are few in number and have little impact on the quality of the receiving waters.

Overall the water quality within the basin has shown significant decline as evidenced by the increased number of closures of shellfish harvesting areas from 9 in 1975 to 17 in 1985. The major closing was due to elevated levels of PCB's and heavy metal concentrations in the shellmeats from the waters around New Bedford Inner and Outer Harbors. The balance of closures are due to elevated levels of coliform bacteria above the allowable standards.

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Figure 6 BUZZARDS BAY BASIN (95)

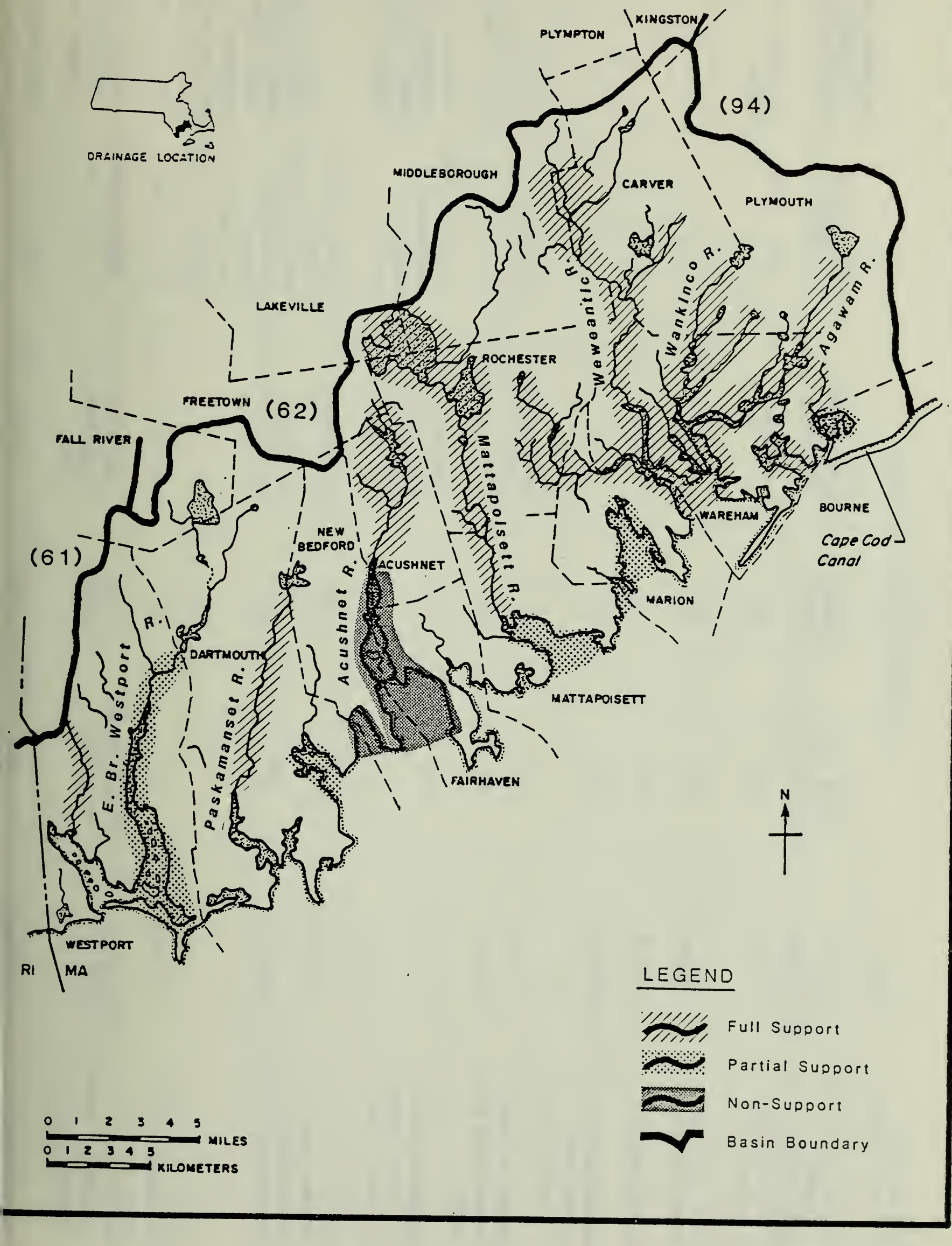

TABLE 16
BUZZARDS BAY DRAINAGE BASIN

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Buttermilk Bay	0.74 mi^2	SA	PS	Coliforms.	Street runoff.	Currently under study.
Onset Bay	0.78 mi^2	SA	S	--	--	--
Wareham River	2.6-0.0	SA		--	--	--
Weweantic River, downstream Horseshore Pond	4.4-0.0	SA	S	--	--	--
Sippican River, County Road to mouth	2.1-0.0	SA	S	--	--	--
Sippican Harbor	2.76 mi^2	SA	PS	Coliform.	Street runoff. Heavy boat usage.	Improve Street Drainage Management; Tight Tank Bylaw.
Aucoot Cove	0.47 mi^2	SA	PS	Coliform.	--	--
Mattapoisett Harbor	1.02 mi^2	SA	PS	Coliform.	Street runoff. Heavy boat usage.	Improve Street Drainage Management; Tight Tank Bylaw.
Westport River, West Branch	4.5-0.0	SA	S	--	--	--
Outer New Bedford Harbor	4.1 mi^2	SA	NS	Dissolved oxygen. Coliform. PCB.	WWTP sediment.	Upgrade of WWTP currently under study.
Clark Cove	1.15 mi^2	SA	NS	Coliform. PCB.	CSO.	CSO control.

TABLE 16 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Apponagansett Bay	0.91 mi^2	SA	NS	Periodic coliform	Street land runoff faulty systems. Boat usage.	Currently under source removal program needs to be resampled.
Westport River, East Branch from County Road to mouth	10.0-0.0	SA	PS	Periodic coliform	Potential agricultural runoff. Street runoff.	Tight Tank Bylaw currently under study.
Acushnet River from main street to Route 6	4.5-1.0	SB	NS	Dissolved oxygen Coliform bacteria Heavy metals PCB	CSO. Sediment. Residuals.	Control of CSO. Control PCB in sediment.
New Bedford Inner Harbor	1.0-0.0	SB	NS	Dissolved oxygen Coliform bacteria Heavy metals PCB	CSO. Sediment. Residuals.	Control of CSO. Control PCB in sediment.
Agawam River	10.6-0.0	B	S	--	--	--
Wankinco River	4.5-0.0	B	S	--	--	--
Weweantic River, above Horseshoe Pond	12.2-4.4	B	S	--	--	--
Sippican River, above County Road	6.8-2.1	B	S	--	--	--
Mattapoisett River	9.5-0.0	B	S	--	--	--
Acushnet River to Hamlin Road	8.2-5.5	B	S	--	--	--

TABLE 16 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Paskamanset River	9.6-0.0	B	S	--	--	--
Shingle Island River	5.2-0.0	B	S	--	--	--
Acushnet River from Hamlin Road to Main Street	5.5-4.5	B	NS	Dissolved oxygen Coliform bacteria	Agricultural runoff.	Correct runoff from farm.
Westport River, East Branch from outlet of Noquochoke Lake to Old County Road	12.0-10.0	B	PS	Coliform bacteria	Unknown source.	Determine current water quality; make appropriate abatement program.

Miles Assessed: 81.2 mi
Miles Supporting Classification: 68.2 mi
Miles Partially Supporting Classification: 12.0 mi

Square Miles Assessed: 11.93 mi^2
Square Miles Supporting Classification: 0.78 mi^2
Square Miles Partially Supporting Classification: 4.99 mi^2

CAPE COD DRAINAGE BASIN (96)

Description of the Watershed

Cape Cod consists of 15 towns with a permanent 1980 population of 147,925. Its total area is 410 square miles of which 17 are covered by lakes and ponds. The Cape is devoid of any long rivers and streams. The Herring River, six miles in length, is tne longest river on Cape Cod.

Although there are only a few small freshwater streams, ponds and lakes are abundant on Cape Cod. Most ponds are relics from the last period of glaciation which ended approximately 15,000 years ago. The ponds are often the result of the depressions intersecting the groundwater table. The groundwater is naturally low in nutrients and is slightly acidic. The Massachusetts Division of Fisheries and Wildlife has, on occasion, added lime to some ponds to neutralize them and to increase the productivity of fisheries.

Cape Cod with approximately 300 miles of shoreline is renowned for its beaches, swimming and other water based activities. Shellfishing, both recreational and commercial, is a large scale endeavor. Although the hard shell clams (Mercenaria mercenaria) are the main shellfish harvested chiefly from the Buzzards Bay area, some attempts to grow oysters on the south side of the Cape have also been made. Softshell clams and Bay-scallops are also important commercial species.

The groundwater system, which expresses itself at the surface in ponds, is the most important freshwater resource on the Cape. Groundwater is the water supply source for all drinking water on Cape Cod and is also the eventual receiving water for discharges from the few municipal and other treatment plants which now exist along with all of the individual home disposal systems.

Cape Cod is being considered for designation as a sole-source aquifer. This designation would mean that any federally funded project would be subjected to careful review before it was approved in order to protect groundwater quality.

Water Quality Conditions and Trends

The Cape's increasing water quality problems can be characterized by increasing demands on a limited resource. The Cape's location places it within a one day's drive of roughly one-third of the nation's population. Further,its permanent population of approximately 150,000 people swells to 2 or 3 times that figure during the summer months with the influx of second home owners and vacationers.

The Cape's 300 miles of coastline, streams, embayments, salt ponds and estuaries must support a wide range of uses, the most sensitive being shellfish harvesting and swimming. They must also function as wildlife habitats, accomodate marinas, and serve as a receptacle for stormwater runoff. These coastal waters appear to be showing signs of stress as exemplified by the increasing number of closures of shellfish harvesting areas, reported algal blooms and occasional fish kills. The principal sources of these problems appear to be stormwater runoff as it is associated with land development practices, marinas with poor waste disposal practices, failing septic systems, agricultural runoff and large populations of waterfowl. Because the Cape contains many individual streams, embayments and

estuaries, it is necessary to evaluate each system on an individual basis, a costly and time consuming process.

The Division needs to update its limited data base in order to make better assessments as to the nature and extent of the perceived problems. The major problems associated with the Cape's fresh surface waters also appear to be related to eutrophication due to inputs of nutrients such as nitrogen and phosphorus loadings from faulty septic systems, fertilizer runoff from golf courses, lawns and agricultural practices. In addition, the already acidic conditions exhibited in many of the lakes and ponds could be furtner exacerabated by acid rain.

Groundwater is the major source of drinking water on the Cape and as such must be fully protected. In various locations on Cape Cod, groundwater quality is threatened by the natural occurrence of iron and manganese or by saltwater intrusion. The latter has occurred in the North Truro-Provincetown area dating back to the 1930's. Future treatment may be necessary to remove iron and manganese from groundwater should their concentrations be high enough to hinder water use. Finally, elevated nitrates in groundwater resulting from overloaded or densely situated on-lot subsurface disposal systems, increased fertilizer use, and wastewater treatment plant discharges to the ground may threaten groundwater use as a drinking water supply in some areas.

Waste disposal practices on the Cape are largely individual subsurface disposal systems. This is a consequence of the essentially rural character of the area and the predominant porous soils. Larger treatment facilities with final effluent disposal to the ground are located in Hyannis, Chatham, Falmouth, Wellfleet and at the Otis and North Truro Air Force Bases.

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Figure 7 CAPE COD BASIN (96)

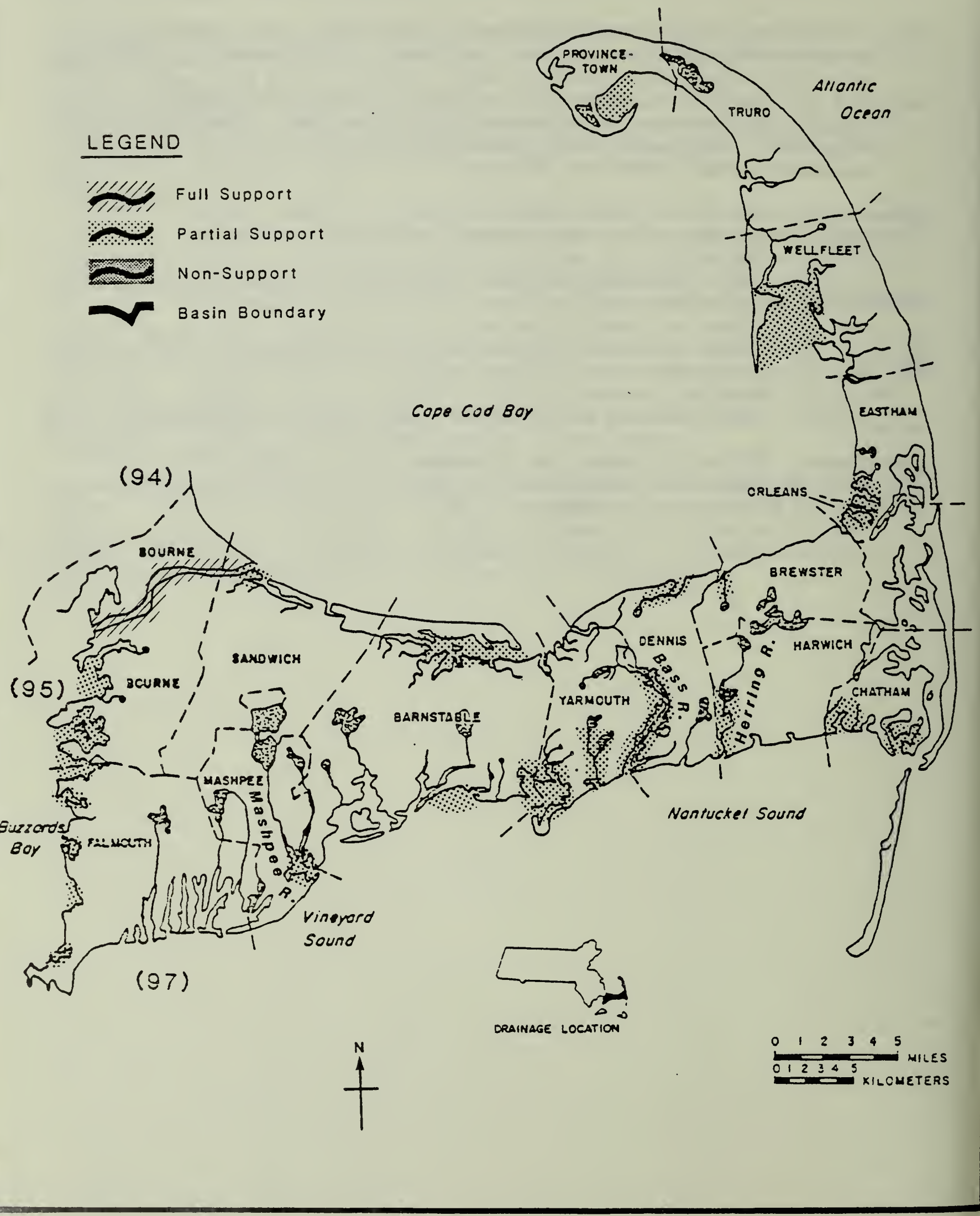

TABLE 17
CAPE COD DRAINAGE BASIN

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Old Harbor Creek, Scorton Creek, Namskaket Creek, Herring River, Pamet River, Frostfish Creek, Swan Pond River, Herring Brook, Red Brook, Nauset Harbor (2.0 mi^2), Chatham Harbor (6.06 mi^2), Hyannis Harbor (0.47 mi^2), Waquoit Bay (1.54 mi^2), Little Harbor (0.05 mi^2), Great Harbor (0.35 mi^2), Quisset Harbor (0.15 mi^2), West Falmouth Harbor (0.28 mi^2), Phinney's Harbor (1.46 mi^2).	12.36 mi^2	SA	PS	Occassional high coliform. Nutrients.	Street runoff. Faulty septic systems. Marinas.	Septic system Rehabilitation. Improve pump out facilities at marinas, sealed head by-laws. Re-evaluate storm water management practices.
Mill Creek, Chase Garden Creek, Parkers River, Sesuit Creek, Quivett Creek, Little Namskaket Creek, Red River, Herring River, Barnstable Harbor (2.56 mi^2), Lewis Bay (1.35 mi^2), Centerville Harbor (1.44 mi^2).	5.35 mi^2	SA	PS	Occassional high coliform.	Street runoff. Faulty septic systems. Agricultural runoff.	Septic system rehabilitation. Facilities planning in Sandwich, Bourne. Re-evaluate storm water management practices.

TABLE 17 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Rock Harbor Creek, Boat Meadow River, Bass River, Wellfleet Harbor (7.27 mi^2), Provincetown Harbor (3.82 mi^2), Stage Harbor (0.86 mi^2), Megansett harbor (1.39 mi^2).	13.34 mi^2	SA	PS	Occassional high coliform.	Street runoff. Faulty septic systems. Marinas.	Re-evaluate storm water management practices. Septic system rehabilitation. Improve pump out facilities at marinas, sealed head by-laws.
Cape Cod Canal (Sandwich); Cape Cod Canal (Bourne)	6.0 mi	SB	S	Coliform.	Heavy boat traffic.	Sealed head by-laws.

Miles Assessed: 6.0 miles
Miles Supporting Classification: 6.0 miles
Miles Partially Supporting Classification: 0.0 miles

Square Miles Assessed: 31.05 mi^2
Square Miles Supporting Classification: 0 mi^2
Square Miles Partially Supporting Classification: 31.05 mi^2

CHARLES RIVER BASIN (72)

Description of the Watershed

The Charles River, the longest river in Massachusetts with a length of 80 miles, begins at a spring on the southerly slope of Honey Hill in the town of Hopkinton. From this humble beginning the river meanders its way through numerous communities in eastern Massachusetts and culminates by discharging into Boston Harbor at the outlet of the Charles River Basin. The initial flow of the river is southerly through the towns of Milford and Hopedale. It then pursues a zig-zag route in a generally northeasterly direction through the communities of Bellingham, Medway, Millis, Norfolk, Medfield, Sherborn, Dover, Wellesley, Needham, Dedham, Newton, Waltham, Watertown, Cambridge and Boston. The river basin encompasses an area of 307 square miles and is somewhat hour-glassed in shape. The watershed is between five and 15 miles wide and approximately 31 miles in length. With a beginning elevation of 500 feet above mean sea level, the river ends at sea level in Boston Harbor.

An outstanding feature of the Charles River is its meandering nature through extensive wetlands which border the river through much of its course. These wetlands account for about 20,000 acres, approximately one tenth of the watershed area. This buffer zone acts as a significant area of wildlife propagation and as a natural hydraulic storage area which can help dampen peak flood flows.

The stream flow of the river is monitored by two USGS stream gages, one located in Millis with a drainage area of 85.9 square miles and the other located in Dover with a drainage area of 184 square miles. The average yearly flow at the gages are 162 and 303 cubic feet per second (cfs), respectfully. The extremes for low and high flows are 12 and 2,150 cfs for Millis and 0.9 and 3,220 cfs for Dover. In the town of Dedham, approximately one-third of the Charles River flow is diverted through the Mother Brook diversion to the Neponset River. The diversion was originally constructed for hydro-power but its current status has been relegated to flood control purposes. It has been proposed by the Division that the diversion be eliminated except in times when flood control is necessary. This program would allow the Charles River to maintain a higher streamflow which would increase its assimilative capacity.

Several tributaries flow into the Charles River with the most important being: Mine Brook in Franklin; Chicken Brook in Holliston and Medway; "Sugar" Brook in Millis; Bogastow Brook in Holliston, Sherborn and Millis; and Stop River in Norfolk. These tributaries contribute flow to the mainstem Charles River, provide attenuation of flood flows and also receive wastewater discharges.

The upper portion of the Charles River receives discharges from the Milford, Upper Charles, and Medfield wastewater treatment facilities. The upgrading of the Milford facility is scheduled to be completed in the spring of 1986, while the others are advanced treatment plants. The Millis WWTP, which discharges to "Sugar" Brook, is scheduled to connect to the Upper Charles WWTP while the Medfield State Hospital, which discharges to the Charles River, is scheduled to connect to the Medfield WWTP. Pondville Hospital WWTP, Norfolk-Walpole MCI WWTP and the Wrentham State Hospital WWTP discharge to the Stop River. These facilities are currently being evaluated by the Division and upgradings will be instituted as necessary.

The middle and lower portions of the Charles River Basin are serviced by the Metropolitan Sewerage District system which conveys its wastewater to the Deer Island and Nut Island WWTP's in Boston Harbor. Thus, there are no significant discharges to the Charles River in this portion of the river. The main detrimental impacts are from stormwater and urban runoff associated with streams in heavily developed areas.

Water Quality Conditions and Trends

Significant water pollution abatement actions (as referenced above) and numerous industrial dischargers which have gone out of business have vastly improved the water quality of the Charles River. The major problems remaining in the basin are: impacts from the Milford WWTP, especially in the area of Box Pond; low dissolved oxygen levels in the Stop River, which are caused by a combination of the discharge from the Norfolk-Walpole MCI WWTP and the natural oxygen demand exerted by the wetlands of the stream; moderate eutrophication caused by impounded waters that still receive high levels of nutrients; and stormwater that carries silt, oil and grease, and bacteria.

The problems caused by the direct discharges from the Milford WWTP and the Norfolk-Walpole MCI WWTP will be significantly reduced by future abatement actions at those facilities. Due to the hydraulics of the river and the loading of nutrients sufficient to sustain eutrophication, there will continue to be moderate levels of algal activity and eutrophication in the Charles River.

Stormwater inputs to the river can temporarily restrict its usage due to aesthetic problems and bacterial contamination. These problems are time specific and cannot, in reality, be eliminated but must be considered an inherent aspect of an urban stream. These two phenomena will not, however, restrict the uses of the river as a significant water resource. The upper river can be utilized for passive recreation, warmwater fisheries, canoeing and wildlife propagation.

The Charles Basin, located in the last 9.8 miles of the Charles River from the Watertown Dam to the discharge into Boston Harbor at the Charles River Dam, is classified as class C. This is the only freshwater class C segment in the state. Fishing and primary contact recreation are limited although boating, crew racing and secondary recreation are extensively done.

The water quality in the Charles Basin is severely impacted by combined sewer overflows and anaerobic conditions in the lower strata of the basin. The combined sewer overflows are part of a sewage system which is over 100 years old. A CSO study for Boston was conducted in 1980, along with a water quality survey of the basin and tributaries leading into the basin, particularly from Back Bay Fens and the Muddy River. Fecal coliform levels as high as 85,000 per 100 ml were measured in August 1984. Several construction grant projects have been recommended to reduce the coliform bacteria problem and reduce the combined sewer overflows. The required projects are on the Division's extended priority list, but none have received funding today. With reduced federal construction grant monies it is likely that other funding mechanisms will be necessary for these projects.

The other problem, anaerobic conditions caused by rich organic bottom sediments with a dense saline water cover which prevents mixing is improving. Saltwater from the use of the Science Park dam and locks was trapped in the basin, causing anaerobic and septic conditions in the bottom. Steps to remedy this problem have occurred with the reconstruction of the Charles River Dam to reduce the saltwater intrusion and aeration via mechanical aerators to destratify the saline layer. The quality of the Charles Basin is improving but will never get above the class C criteria until the combined sewer overflow problems are corrected.

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Figure 8 CHARLES RIVER BASIN (72)

BASIN AND DRAINAGE LOCATION

LEXINGTON
LINCOLN
ARLINGTON
SOMERVILLE
EVERETT
BELMONT
WALTHAM
Beaver Bk
WATERTOWN
CAMBRIDGE
WAYLAND
WESTON
Stony Bk
Charles R
Watertown Dam
NEWTON
Charles River Dam
S. Meadow Bk
BROOKLINE
Sawmill Bk
BOSTON
WELLESLEY
NATICK
Waban Bk
NEEDHAM
Charles R.
DEDHAM
Mother Bk
ASHLAND
SHERBORN
DOVER
HOPKINTON
WESTWOOD
Echo Lake
HOLLISTON
Chicken Bk
Hopping Bk
Bogastow Bk
MEDFIELD
Sugar Bk
Cedar Swamp Pd.
MILLIS
MEDWAY
Charles R.
Slop
WALPOLE
MIL-FORD
NORFOLK
HOPEDALE
Charles R.
Mine Bk
FRANKLIN
Mill R.
MENDON
FOXBOROUGH
BELLINGHAM
WRENTHAM

N

0 1 2 3 4 5 MILES
0 1 2 3 4 5 KILOMETERS

LEGEND

- Full Support
- Partial Support
- Non-Support
- Basin Boundary

TABLE 18
CHARLES RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Charles River						
Headwaters in Hopkinton to Dilla Street, Milford	78.9-76.5	A	S	--	--	--
Charles River from Dilla Street, Milford to Beech Street, Bellingham	76.5-64.7	B	NS	Coliform bacteria. Dissolved oxygen. Solids.	Milford WWTP. CSO's. Urban runoff.	Milford WWTP is being upgraded. Construction scheduled to be finished spring 1986. Sewer interceptor being installed.
Charles River from Beech Street, Bellingham to Watertown Dam, Watertown	64.7-9.8	B	S	Diurnal dissolved oxygen variation.	Algal, macrophyte activity.	Inherent condition, probably will continue.
Charles Basin Watertown Dam to the Science Park Dam, Boston	9.8-1.2	C	NS	Intermittent coliform bacteria. Dissolved oxygen.	Combined sewer overflows. In-place sediments. Saltwater intrusion.	Combined sewer stratification. Destratification by mixing in progress.
Stop River Headwaters in Wrentham to Norfolk-Walpole MCI WWTP, Cedar Jct.	8.8-4.1	B	S	--	--	--

TABLE 18 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Stop River from Norfolk-Walpole MCI WWTP to confluence with the Charles River, Medfield	4.1-0.0	B	PS	Dissolved oxygen.	Norfolk-Walpole MCI WWTP. Natural wetlands.	Evaluation and control of WWTP. Due to natural conditions of wetlands, D.O. levels will continue.
Back Bay Fens from the Muddy River to the confluence with the Charles Basin, Boston	1.5-0.0	C	NS	Coliform bacteria. Dissolved oxygen.	Combined sewer overflows. In-place sediments.	Combined sewer separation. Dredging of sediments.
Muddy River from Jamaica Pond to the Back Bay Fens, Boston	2.7-0.0	B	NS	Coliform bacteria. Dissolved oxygen.	Combined sewer overflows.	Combined sewer separation.

Miles Assessed: 90.7 mi
Miles Supporting Classification: 62.0 mi
Miles Partially Supporting Classification: 4.1 mi

CHICOPEE RIVER BASIN (36)

Description of the Watershed

The Chicopee River Basin covers an area of over 720 square miles in central Massachusetts. All or part of 32 towns lie within the basin, with the majority of the population concentrated in the Springfield Metropolitan Area. Generally, the remaining area typifies the image of rural New England countryside with rolling hills, woodlands, small ponds, and winding brooks.

The basin includes four major adjoining river systems--the Ware River, Swift River, Quaboag River, and the Chicopee River--which together contribute an average flow of about 925 cubic feet per second (598 million gallons per day) to the Connecticut River.

The Ware River is formed by the confluence of the east and west branches in Barre. The west branch drains a swamp in Hubbardston while the east branch, which carries the greater flow, originates in Rutland. From their confluence the Ware River flows generally southwest for a distance of 34 miles, dropping in elevation some 380 feet and draining an area of 219 square miles. Classified A in its upper reaches, Ware River water is diverted by the Metropolitan District Commission to Quabbin Reservoir. Below the reservoir intake to just below Barre center the river is classified B. It receives untreated sewage from Barre, treated sewage from Hardwick and Ware, and industrial discharges from Barre, Ware and Palmer. Also, three major impoundments impede its progress in Hardwick, Ware, and Palmer. The Ware River joins the Quaboag River at Three Rivers in Palmer.

The three upper branches of the Swift River flow into Quabbin Reservoir, a major component of the water supply of metropolitan Boston. Quabbin Reservoir was formed by the construction of Windsor Dam which now controls the upper 186 square miles of drainage area of the Swift River. Below Quabbin, the largest inland body of water in Massachusetts, the Swift River continues in a southerly direction for 10 miles until its confluence with the Ware River, less than a mile above Three Rivers, and drains an additional 30 square miles. Above Windsor Dam the Swift River is classified A and below the dam it is classified B.

The Quaboag River flows in a southwesterly direction for over 37 miles until it joins the Ware River at Three Rivers. Along this course the elevation drops some 650 feet. From its source in Spencer the river is known first as the Seven Mile River, which joins the East Brookfield River, which in turn enters Quaboag Pond. Emerging from Quaboag Pond in a flat swampy area, the Quaboag gathers flow and velocity encountering only one small impoundment in west Warren before it joins the Ware River. The Quaboag River drains 210 square miles and is classified B, except for a few reservoirs on its tributaries which are classified A. The Quaboag receives domestic discharges from Spencer and the Brookfields, as well as Warren and Palmer. Small industrial discharges are located in Brookfield, Warren and Palmer.

The confluence of the Ware and Quaboag Rivers forms the Chicopee River, which continues 18 miles through the more heavily populated and industrialized portion of the basin and over a series of dams, some of which can regulate the flow. The Chicopee River is classified B and receives both domestic and industrial discharges along its course, until it joins the Connecticut River in Chicopee.

Water Quality Conditions and Trends

The Ware River in general meets existing class B water quality standards. Barre Center and South Barre contribute high coliform densities from domestic waste discharges and the septic system at Ivy Enterprises (formerly Barre Wool Combing). All domestic waste discharges will be eliminated during the next three years with the construction of a collection and treatment system. Funding for this project was approved by the town in 1985. In the interim, the septic tank at Ivy Enterprises will be repaired and disinfection will be required.

The Ware River below the town of Ware had been polluted by industrial and domestic wastewater until the spring of 1985. The Ware WWTP was upgraded to advanced waste treatment and ammonia and phosphorus removal began in April 1985. Pretreated industrial wastewater is now tied to the new treatment system. Occasionally phosphorus and bacteria concentrations increase in the Ware River, possibly from agricultural runoff near Gibbs Crossing.

The upper reaches of the Quaboag River, including the Seven Mile and East Brookfield Rivers, are sensitive to domestic wastewater and agricultural runoff. Although existing discharges to the stream are highly treated, dissolved oxygen class B violations are common. The Seven Mile River's water quality problems will be alleviated with the design and construction of an advanced waste treatment system containing nutrient removal in an artificial wetland. Funds for construction are scheduled to become available in March 1986. Dunn Brook, a tributary to the Quaboag River in Brookfield, violates class B criteria with high concentrations of total phosphorus below the discharge of the North Brookfield WWTP. A facility plan for advanced waste treatment is currently underway. Phase I is scheduled to be completed in March 1986. The Quaboag River from West Brookfield to Monson has high coliform densities due to overland runoff and the Warren WWTP. Design and construction of a new secondary treatment facility at Warren will be completed within a few years. The Palmer-Monson sewage collection system has had several domestic discharges, combined sewers and industries tie in to its system, further reducing high coliform levels in the Quaboag River.

The Chicopee River water quality has improved due to the completion of the Palmer WWTP in 1980, the elimination of individual discharges in Palmer and Monson, and the tie-in of high strength industrial wastes to the Springfield Regional Wastewater Treatment Facility at Bondi Island. The Wilbraham Wastewater Treatment Plant will be converted to a pumping station to transport waste to Bondi Island. Class B standards are thus generally met in this segment except during storm events when combined sewers discharge domestic wastewater to the river.

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Figure 9 CHICOPEE RIVER BASIN (36)

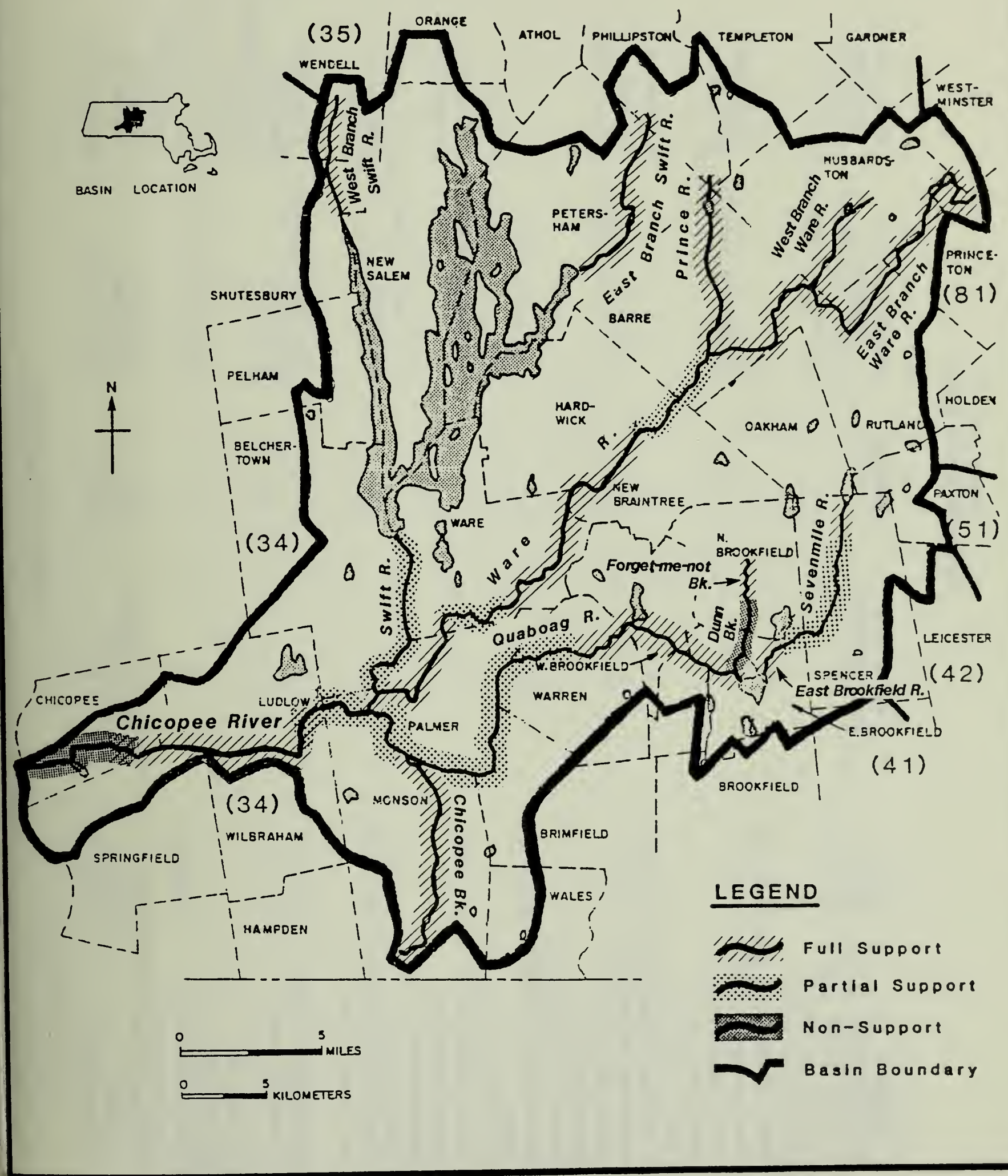

TABLE 19
CHICOPEE RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Ware River Basin						
East Branch Ware River from Rutland to Barre Falls Dam, Barre	4.8-0.0	A	S	--	--	--
West Branch Ware River and Ware River above MDC intake, Barre	46.0-29.1	A	S	--	--	--
MDC intake to South Barre	29.1-27.3	B	S	--	--	--
South Barre to Wheelwright Dam, Wheelwright	27.3-23.3	B	PS	Coliform bacteria.	Domestic discharges.	Collection and treatment.
Wheelwright Dam to Ware Dam, Ware	23.3-12.2	B	S	--	--	--
Ware Dam to Gibbs Crossing, Ware	12.2-8.3	B	PS	Coliform bacteria.	Stormwater runoff. Agricultural runoff.	Best management practices (BMP)
Gibbs Crossing to confluence with Quaboag River, Palmer	8.3-0.0	B	S	Phosphorus.	Stormwater and agricultural runoff.	Best management practices (BMP)
Prince River	8.4-0.0	B	S	--	--	--

TABLE 19 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Swift River above Windsor Dam, Belchertown	above 9.8	A	S	--	--	--
Windsor Dam to Bondsville	9.8-4.4	B	PS	Solids. Nutrients.	McLaughlin Fish Hatchery.	Solids removal from fish hatchery effluent.
Bondsville to confluence with Ware River, Palmer	4.4-0.0	B	PS	Occasional coliform bacteria.	Domestic dischargers.	Isolated domestic dischargers.
Quaboag River Basin						
Seven Mile River from Source to Smithville Road, Spencer	8.6-4.0	B	S	--	--	--
Smithville Road to confluence with East Brookfield River, East Brookfield	4.0-0.0	B	PS	Dissolved oxygen.	Spencer WWTP. Natural conditions.	Upgrade Spencer WWTP.
East Brookfield River to Quaboag Pond, East Brookfield	2.2-0.0	B	S	Dissolved oxygen.	Natural conditions.	--
Quaboag River from Brookfield to Route 67 bridge, West Brookfield	24.9-19.2	B	S	Dissolved oxygen.	Natural conditions.	--

TABLE 19 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Route 67 bridge to Route 32 bridge, Palmer-Monson	19.2-5.1	B	PS	Coliform bacteria.	Agricultural runoff.	Best management practices (BMP)
Route 32 bridge to confluence with Ware River, Palmer	5.1-0.0	B	PS	Coliform bacteria.	Stormwater runoff. Isolated domestic dischargers.	Tie in to existing wastewater collection system.
Dunn Brook above North Brookfield WWTP, Brookfield	4.9-3.3	B	S	--	--	--
North Brookfield WWTP to confluence with Quaboag River, Brookfield	3.3-0.0	B	NS	Dissolved oxygen. Ammonia. Phosphorus. Coliform bacteria.	North Brookfield WWTP.	Upgrade North Brookfield WWTP to advanced treatment.
Chicopee Brook, to confluence with Quaboag River, Monson	7.0-0.0	B	S	--	--	--
Chicopee River						
Source in Palmer to Red Bridge impoundment	17.4-15.2	B	PS	Coliform bacteria. Phosphorus.	Urban and agricultural runoff. Palmer-Monson WWTP.	Best management practices (BMP)
Red Bridge Dam to Chicopee Falls, Chicopee	15.2-3.0	B	S	Periodic coliform bacteria.	Urban and agricultural runoff. Palmer-Monson WWTP.	Best management practices (BMP)

TABLE 19 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Chicopee Falls to confluence with Connecticut River, Chicopee.	3.0-0.0	B	NS	Dissolved oxygen. Coliform bacteria.	Combined sewer overflows, urban runoff.	Combined sewer overflow elimination or treatment.

Miles Assessed: 134.5 mi
Miles Supporting Classification: 85.1 mi
Miles Partially Supporting Classification: 43.1 mi

CONNECTICUT RIVER BASIN (34)

Description of the Watershed

The Connecticut River begins in Canada and for most of its course north of Massachusetts serves as the boundary between New Hampshire and Vermont. The river flows essentially due south through Massachusetts from Bernardston and Northfield, on the Vermont - New Hampshire state line, to Agawam and Longmeadow on the Connecticut state line. From this point the Connecticut River flows south through the state of Connecticut to Long Island Sound. The Connecticut River from its source to its mouth is 410 miles long.

The segment of the Connecticut River that travels through Massachusetts is 66 miles long. The drainage area of this river segment is 650 square miles, and the basin has a population of 500,000 people. The four major tributaries to the Connecticut River in Massachusetts are the Millers, Deerfield, Chicopee, and Westfield Rivers. Each of these rivers are dealt with separately in this report. The Connecticut River is the largest river in Massachusetts.

The Connecticut River in Massachusetts is divided into two very different sections by the dam in Holyoke. The upper portion is sparsely populated and has little industrial development. The lower portion has a much greater amount of industrial development. The majority of the basin population is located in the lower portion in the metropolitan Springfield area.

Water Quality Conditions and Trends

Water quality surveys conducted by the Division in 1971 and 1973 showed moderate levels of pollution in some segments of the upper Connecticut River, and severely polluted water in the lower Connecticut River. Since that time, significant progress has been made towards eliminating water pollution in the Connecticut River Basin. Secondary wastewater treatment plants have been completed in Springfield, South Hadley, Holyoke, Northampton, Amherst, Sunderland, Montague and Northfield. Many of these municipal plants also treat significant amounts of industrial waste. Although these plants do experience some operational problems, they generally produce an effluent which meets the limitations contained in their NPDES permits.

The result of this major construction program is a significant improvement in the water quality of the Connecticut River. The Division of Water Pollution Control conducted an intensive survey of the Connecticut River in 1983. The data collected during the survey showed that the water quality of the upper Connecticut River was quite good. Dissolved oxygen levels were well above the class B standard of 5.0 mg/l and nutrients and solids levels were very low. The bacteria standard was met all along the upper Connecticut River, with the exception of the segment from the Turners Falls dam to the Deerfield River confluence. High bacteria levels in this segment are caused by combined sewers in Montague. A sewer separation project is underway which, when completed, will eliminate the problem. The upper Connecticut River has great recreational value. It is very popular for boating, swimming, and fishing.

The 1983 surveys of the lower Connecticut River showed that the water quality has improved greatly since 1973. Dissolved oxygen concentrations were very high, and nutrient and solids levels were low. However, bacteria concentrations were high during both dry weather and wet weather. This is caused by combined sewer overflows and dry weather sewage overflows. The control of the overflows is a major problem. Seven communities in the lower Basin have a total of 120 combined sewer discharges to the Connecticut River or to the lower reaches of the Westfield and Chicopee Rivers.

The Division has funded a major program to develop abatement strategies for CSO's on the lower Connecticut River. It has been conducted in two phases. The first phase was a preliminary study of the problem. The second phase is the equivalent of a Step I facilities plan for the seven communities with CSO's to the lower Connecticut River. The phase II study began in November, 1985, and will be completed by January 1988.

Water quality in the Connecticut River Basin has shown a remarkable improvement in the past ten years. Major treatment plant construction is essentially complete. Control of CSO problems and elimination of operating problems at some treatment facilities are the areas where the Division's efforts are currently directed. The Connecticut River was seriously degraded ten years ago, and unsuitable for recreational use below the Holyoke dam. Today, the entire river is a valuable recreational resource.

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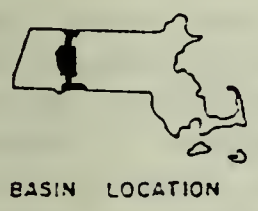
Figure 10

CONNECTICUT RIVER BASIN (34)



BERNARDSTON
VT
NH
MA
LEYDEN
NORTHFIELD
WARWICK
GREENFIELD
GILL
ERVING
MONTAGUE
WENDELL
(35)
DEERFIELD
(36)
CONWAY
(33)
(32)
SUNDER-LAND
LEVERETT
SHUTESBURY
WHATE-LY
GOSHEN
WILLIAMSBURG
HAT-FIELD
CHESTERFIELD
HADLEY
PELHAM
NORTH-AMPTON
AMHERST
WEST-HAMPTON
EAST-HAMPTON
GRANBY
Lampson Bk.
Weston Bk.
Bachelor Bk.
HUNTING-TON
SOUTH-AMPTON
BELCHERTOWN
HOLYOKE
S. HADLEY
LUDLOW
MONT-GOMERY
CHICOPEE
WESTFIELD
WEST-SPRINGFIELD
SPRINGFIELD
MONSON
WILBRA-HAM
AGAWAM
E. LONG-MEADOW
HAMPDEN
MA
CT
LONGMEADOW
Connecticut River

N

0 5 MILES
0 5 KILOMETERS

LEGEND

- Full Support
- Partial Support
- Non-Support
- Basin Boundary

TABLE 20
CONNECTICUT RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Connecticut River						
NH line to Turners Falls Dam, Montague	138.2-123.8	B	S	--	--	--
Turners Falls Dam to confluence with Deerfield River, Greenfield	123.8-120.8	B	PS	Occassional coliform violations.	CSO's from Turners Fall section of Montague.	Control of CSO's
Deerfield River to Holyoke Dam, Holyoke	120.8-86.6	B	S	--	--	--
Holyoke Dam to CT line, Longmeadow/ Agawam	86.6-70.7	B	PS	Coliform violations.	CSO and dry weather sewer overflows.	Control of CSO's/DWO's.
Weston Brook, Lampson Brook, Belchertown-Granby	12.4-9.1	B	PS	Nutrients. Dissolved oxygen.	Belchertown STP discharge.	Eliminate discharge.
Outlet of Forge Pond in Granby to the Connecticut River in South Hadley	9.1-0.0	B	S	--	--	--

Miles Assessed: 79.9 mi
Miles Supporting Classification: 57.7 mi
Miles Partially Supporting Classification: 22.2 mi

DEERFIELD RIVER BASIN (33)

Description of the Watershed

The Deerfield River represents a classic example of a formerly "wild river" which has been tamed by man. For most of its course in Massachusetts the Deerfield once ran through deep valleys on a steep gradient. The gradient decreased and the velocity lessened in the last few miles as the Deerfield flowed across the flood plain of the Connecticut River, but even at this point the Deerfield still was shallow and flowed rapidly to its confluence with the Connecticut River. Now the flow of the Deerfield is continually interrupted by power dams located along its course in Massachusetts and Vermont.

The headwaters of the Deerfield are in Vermont. After flowing through a series of reservoirs constructed by the electric utility companies, the Deerfield first enters Massachusetts as the discharge from Sherman Reservoir. For most of its length in Massachusetts, the river is alternately impounded behind electric utility dams, or flows on a steep gradient through sparsely populated valleys until it reaches the next downstream impoundment. After flowing for 44 miles through Massachusetts, the Deerfield joins the Connecticut River at the Greenfield-Deerfield town line.

Major tributaries to the Deerfield in Massachusetts are the North River and the Green River. These join the Deerfield in Shelburne Falls and Greenfield, respectively. Several of the tributaries to the Deerfield are either presently in use as water supplies or are being considered for future use as water supplies.

The population of the Deerfield Basin in Massachusetts was 30,823 in 1980. The average flow in the Deerfield at its confluence with the Connecticut River is 1,285 cfs. This is the average discharge reported by the USGS for the last 43 years. Wastewater treatment plant flows to the Deerfield Basin are somewhat less than 10 percent of the low flow stream discharge. The seven day low flow (7Q10) is 95.6 cfs, as compared to the sum of all the treatment plant flows reported by MDWPC for 1981, which equal 7.6 cfs.

Water Quality Conditions and Trends

The major wastewater discharges to the Deerfield are the heated discharge from the Yankee Atomic Plant at Rowe, the discharge from the Deerfield Specialty Products Wastewater Treatment Plant in Monroe Bridge, the treated discharge from Kendall Fiber Products in Colrain, treated domestic sewage discharges from the Old Deerfield, Greenfield and Buckland/Shelburne Sewage Treatment Plants, and untreated domestic sewage discharges from Charlemont and Ashfield.

A report on the Yankee Atomic discharge and the Bear Swamp Pumped Storage Project concluded that these do not have a significant deleterious effect on the river. This report was the result of several years of study by the Massachusetts Division of Fisheries and Wildlife and the New England Power Company and was released jointly by these two parties.

Proposed construction projects for a wastewater treatment plant and sewer interceptors for the towns of Charlemont and Ashfield are currently in the planning stages. These projects will alleviate the pollution caused by the untreated domestic sewage discharges in these towns. The only remaining significant problems in the Deerfield Basin are in the town of Greenfield. Combined sewer discharges in this town will be eliminated as part of an ongoing town project. The other problem in Greenfield is the wastewater treatment plant. This plant consistently discharges a highly treated secondary effluent. Unfortunately, this is discharged to the Green River which has only minimal flows in the summer. In order to meet class B standards in the Green River, a higher degree of treatment may be required than is possible in a secondary plant. The most economical solution to this may be to pipe the Greenfield discharge to the nearby Deerfield River where secondary treatment will be adequate. A detailed evaluation of this situation is required.

All significant sources of pollution in the Deerfield Basin are currently receiving secondary treatment. It is expected that the remaining pollution problems in Charlemont, Ashfield, and Greenfield will be eliminated in the next few years as part of ongoing pollution abatement programs.

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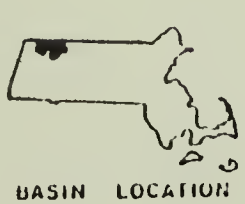
Figure 11

DEERFIELD RIVER BASIN (33)



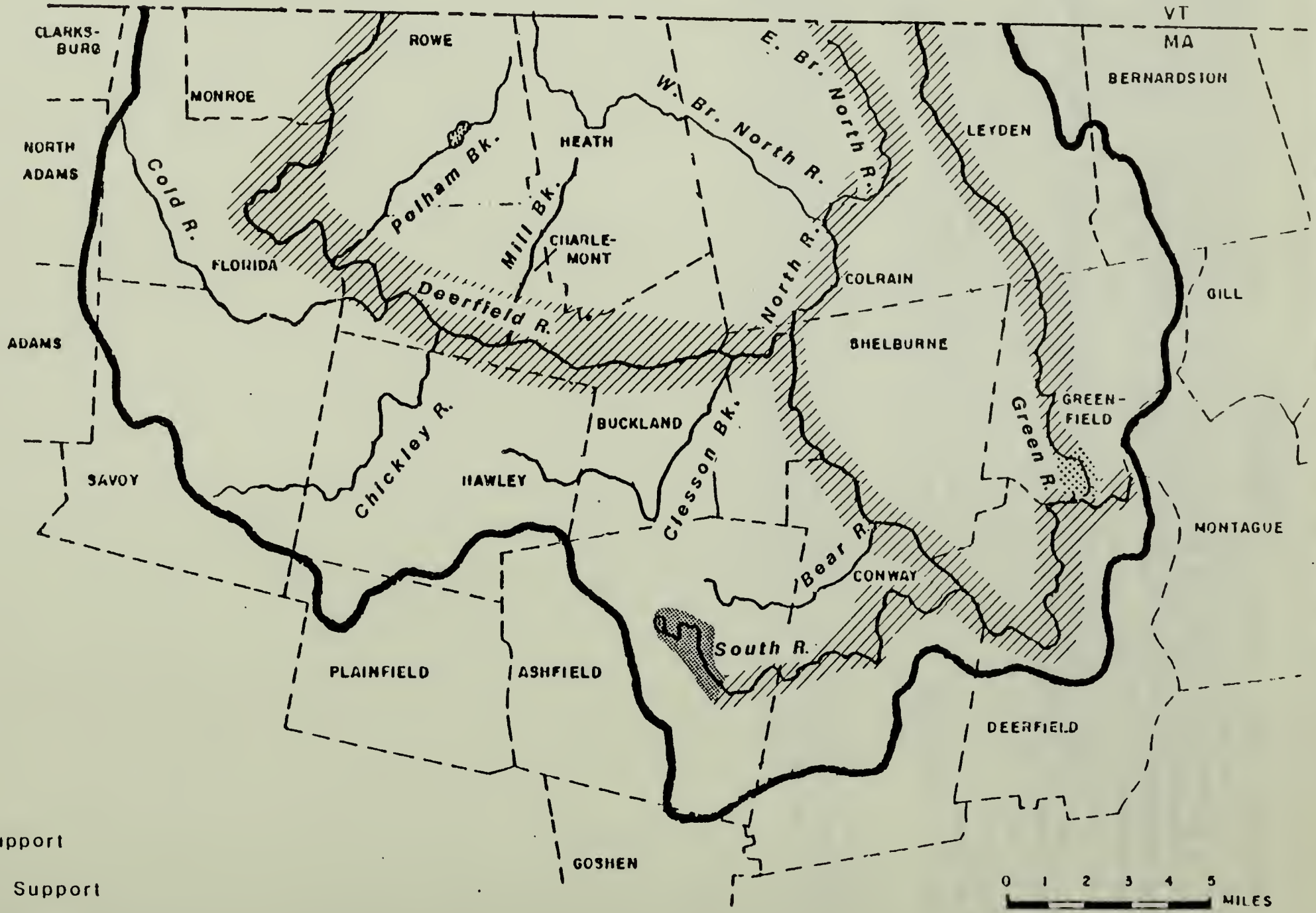


TABLE 21
DEERFIELD RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Deerfield River						
Vermont Line to Cold River, Charlemont	42.4-29.6	B	S	--	--	--
Cold River to Dam 4, Charlemont	29.6-19.7	B	S			
Dam 4, Charlemont to Connecticut River, Greenfield-Deerfield	19.7-0.0	B	S	--	--	--
North River						
Vermont line to Deerfield River, Charlemont-Shelburne	9.5-0.0	B	S	--	--	--
Green River						
Vermont line to Greenfield STP, Greenfield	14.0-0.5	B	S	--	--	--
Greenfield STP to Deerfield River, Greenfield	0.5-0.0	B	PS	Nutrients. Chlorine residual. Solids.	Greenfield STP.	Pipe Greenfield STP directly to Deerfield River.
South River						
Outlet Ashfield Pond to Emmets Road, Ashfield	13.3-11.4	B	NS	Coliform bacteria. Nutrients.	Untreated discharges from the town of Ashfield.	Treatment must be provided for Ashfield Center discharges.

TABLE 21 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Emmets Road, Ashfield to Deerfield River, Conway	11.4-0.0	B	S.	--	--	--

Miles Assessed: 79.2 mi
Miles Supporting Classification: 76.8 mi
Miles Partially Supporting Classification: 0.5 mi

FARMINGTON RIVER BASIN (31)

Description of the Watershed

The Farmington River drains an area of 602 square miles within Massachusetts and Connecticut. Approximately 149 square miles (25 percent) are located in southwestern Massachusetts between the Housatonic and Westfield River Basins.

A major portion of the 149 square miles drains the west branch of the Farmington River and its tributaries. The remaining area drains into pond and valley brooks, which form the east branch of the Farmington River, just below the state line in Connecticut. The terrain throughout the river basin is hilly with large, relatively flat areas occurring on the hill tops at about 1200 feet above mean sea level. These areas produce many small feeder streams to the main branches and their tributaries.

Two major tributaries are the Clam and Fall Rivers. Fall River is formed by Big Pond and Otis Reservoir. Flow in the river is regulated by Otis Reservoir which is used for storage and recreational activities. The United States Geological Survey operates a flow gage on the Fall River in Otis. This gage drains an area of 16.5 square miles and has an average discharge of 49 cubic feet per second. The headwaters of the Clam River are formed by many small streams in uninhabited mountain wilderness. The Clam River is joined by the Buck River about two miles above its confluence with the west branch of the Farmington River. This river is characterized by rapids created by an average fall of about 100 feet per mile.

Water Quality Conditions and Trends

A water quality survey was conducted by the Division's Technical Services Branch in June and August 1974. Results indicated that there are no water quality problems within the Farmington River Basin. There are no point source discharges within the basin. The Division has assigned 13.4 river miles of the Farmington and Fall Rivers as anti-degradation as well as all other waters of the Farmington River Basin. This action prevents any future municipal and industrial discharges to these waters. Therefore, high water quality conditions are expected to continue.

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Massachusetts Division of Water Pollution Control. 1975a. The Farmington River: 1974 Water Quality Analysis and Water Quality Management Plan. Westborough, Massachusetts. 112 pp.

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Figure 12

FARMINGTON RIVER BASIN

(31)

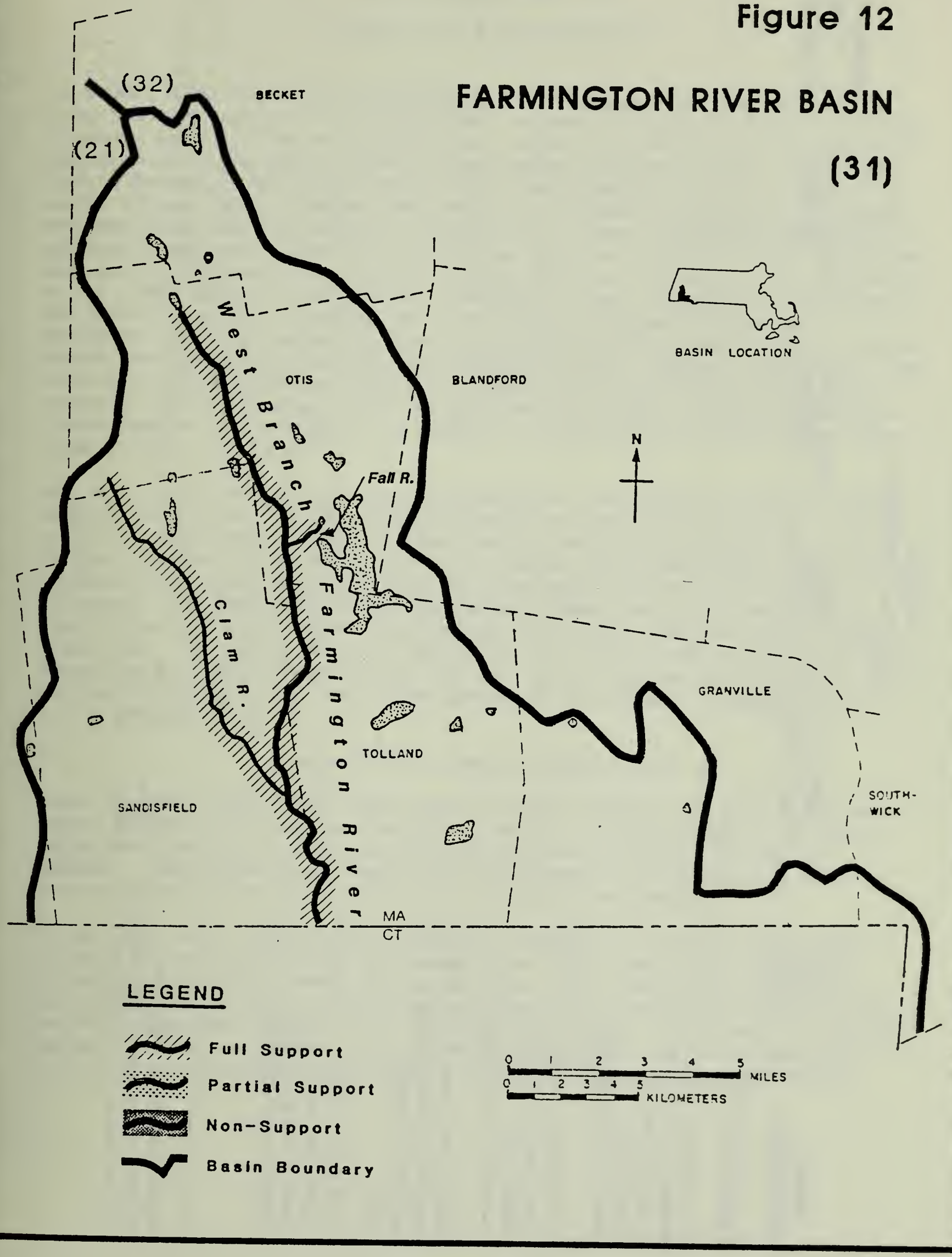

TABLE 22
FARMINGTON RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Farmington River						
West Branch from Becket to 1,000 ft. from Connecticut state line, Standisfield-Tolland	14.6-0.1	B	S	--	--	--
West Branch 1,000 ft. from state line to state line, Standisfield-Tolland	0.1-0.0	A	S	--	--	--
Fall River from source to confluence with West Branch, Otis	1.0-0.0	B	S	--	--	--
Clam River from source in Otis to confluence with West Branch, Sandisfield.	10.0-0.0	B	S	--	--	--

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Miles Assessed: 25.6 mi
Miles Supporting Classification: 25.6 mi
Miles Partially Supporting Classification: 0.0 mi

FRENCH RIVER BASIN (42)

Description of the Watershed

The French River is a major tributary of the Quinebaug River and extends 26 miles from its source in Greenville Pond, Leicester, to the confluence with the Quinebaug River in Thompson, Connecticut. From its headwaters at Sargent Pond, Leicester (this portion is known as Town Meadow Brook and extends from Sargent Pond to Greenville Pond) the French River flows generally south throughout its length through Oxford, Dudley, and Webster to Thompson, Connecticut. Probably the best known feature along the French River is Lake Chargoggagoggmanchaugagoggchaubunagungamaugg (also known as Webster Lake) which not only has the longest name but is also one of the largest natural lakes in the state. The lake drains to the French River via Mill Brook in Webster. Other tributaries discharging to the French River are generally small and include Burncoat, Bartons and Grindstone Brooks in Leicester; the Little River and Wellington Brook in Oxford; Potash Brook in Webster; and Backwater and Sunset Hill Brooks in Thompson. The Leicester, Oxford-Rochdale, Dudley, and Webster wastewater treatment plants discharge their effluents to the French River along with industrial discharges from Worcester Tool & Stamping in Leicester and non-contact cooling water from Asoma Polymer in Oxford.

Two major flood control dams were constructed in the French River Basin within Massachusetts by the U.S. Army Corps of Engineers following extensive flooding in 1955. These are the Hodges Village Dam on the French River and the Buffumville Dam on the Little River. The United States Geological Survey (USGS) maintains three flow gaging stations in Massachusetts in the French River watershed. The USGS gage located at Hodges Village drains an area of 31.0 square miles and its discharge has averaged 53.8 cubic feet per second (cfs) since 1962. The gaging stations located on the Little River and French River in Webster have average discharges of 47.7 cfs and 157 cfs and drain areas of 27.7 mi^2 and 85.3 mi^2, respectively. The periods of record are 42 years and 32 years, respectively.

Water Quality Conditions and Trends

Since the early 1800's the French River has been subjected to high loadings of oxygen demanding and nutrient laden pollutants. A large number of mills and factories sprang up in areas adjacent to the river in Oxford, Dudley and Webster. Today these towns remain industrialized with manufacturing of tool and die shops and cotton and rayon cloth printing and dyeing.

In the late 1960's industries and domestic wastewater discharges contributed to the poor water quality of the French River. As a result, a program was initiated to alleviate water quality problems. The Federal Water Pollution Control Act (PL 92-500) of 1972 provided funding for the construction of municipal wastewater facilities and the elimination of direct discharges of untreated sewage or industrial wastes. In the French River Basin municipal treatment facilities are operating in Leicester, Oxford-Rochdale, Webster and Dudley.

Water quality problems do exist in the French River. High nitrogen and phosphorus concentrations are still responsible for algal blooms and characteristic diurnal fluctuations of dissolved oxygen in Dutton Pond and the Perryville Impoundment, which are downstream of the Leicester WWTP and the Webster-Dudley WWTP's, respectively. In addition, the combination of industrial and domestic wastewater discharges have kept segments of the French River from meeting its B classification. Discharges from the towns of Webster and Dudley.

Water quality improvements to the French River have occurred due to the elimination of industrial discharges. Segments in Webster, Dudley and Rochdale have improved because discharges at Anglo Fabrics, Cranston Print Works, Webster Lens Company and Carleton Woolen were discontinued. Upgrading of the facility at Leicester and a regional advanced secondary treatment plant for Webster and Dudley along with sludge handling at Webster (to be completed within 3 years) should ensure compliance with the Massachusetts Water Quality Standards. An extensive EIS study on various methods to improve the water quality below the Webster-Dudley wastewater treatment plants has been written. Recommendations were made for advanced treatment, low flow augmentation and sediment control in the three impoundments downstream of the Webster-Dudley treatment plants. Final decisions will be made on the abatement strategy in Spring 1986.

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Figure 13 FRENCH RIVER BASIN (42)

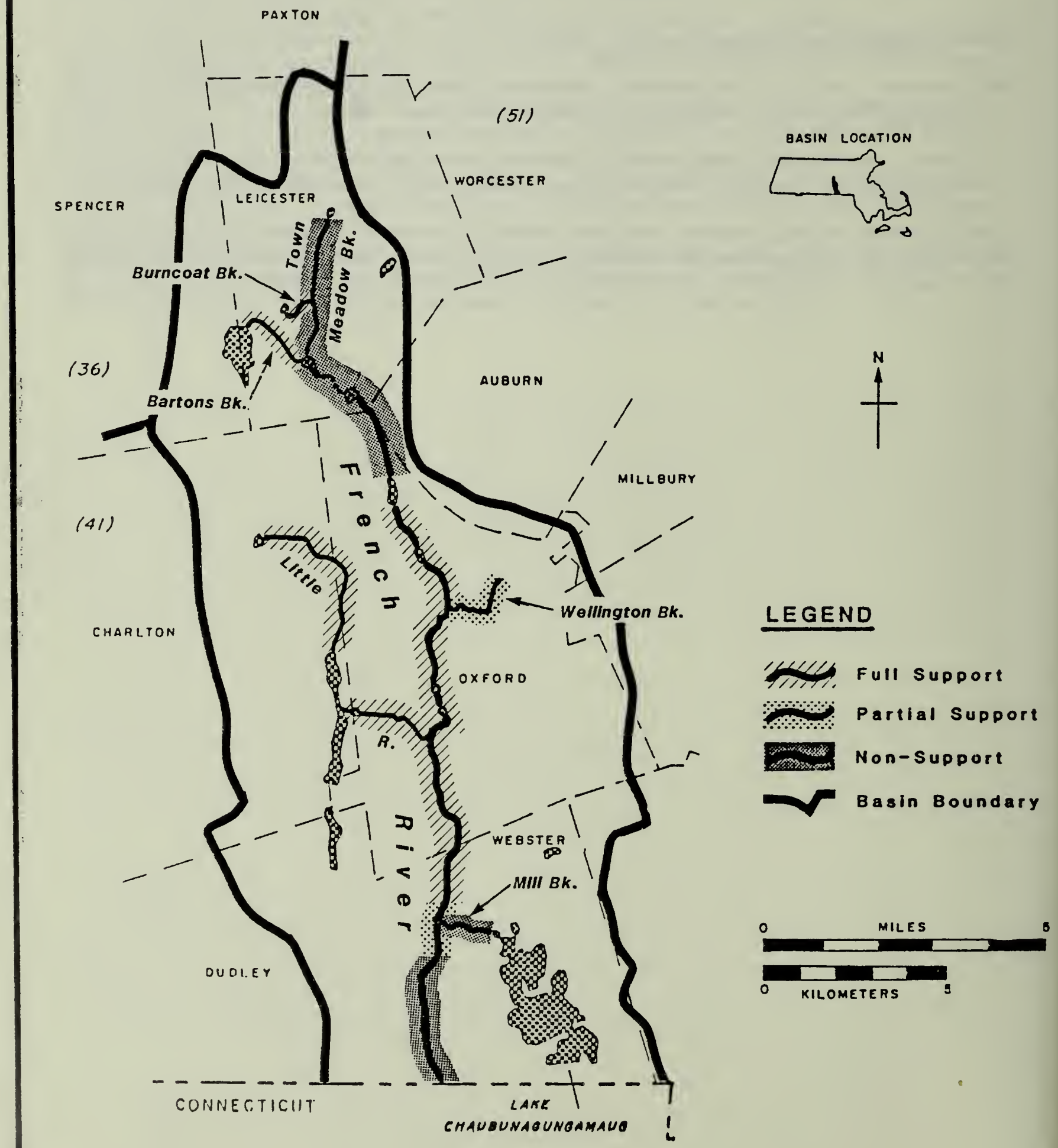

TABLE 23
FRENCH RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
French River						
Above Leicester WWTP, Leicester	27.7-27.3	B	S	--	--	--
Leicester WWTP to N. Oxford Dam, Oxford	27.3-19.3	B	NS	Coliform.	Leicester WWTP.	Advanced secondary treatment at
N. Oxford Dam to North Dam, Webster	19.3-10.0	B	S	--	--	--
North Dam, Webster to Webster-Dudley WWTP's, Webster	10.0-8.5	B	PS	Dissolved oxygen. Coliform.	Impoundments. Urban runoff.	Upgrade Leicester and Oxford-Rochdale WWTP's.
Webster Dudley WWTP's to state line	8.5-7.0	B	NS	Coliform. Solids. Phosphorus. D.O.	Webster WWTP. Dudley WWTP. Sludge deposits.	A sludge handling facility under construction will be completed winter 1985. Advanced treatment for a regional plant for Webster and Dudley has been approved.
Burncoat Brook, Leicester	1.2-0.0	B	S	--	--	--

TABLE 23 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Barton's Brook, Leicester	1.2-0.0	B	S	--	--	--
Little River, Charlton and Oxford	9.1-0.0	B	S	--	--	--
Mill Brook, Webster	0.8-0.0	B	NS	Dissolved oxygen.	Cranston Print. Sediments.	Cranston has tied into town sewer but cooling water and sediment remain problems.
Wellington Brook, Oxford	2.5-0.0	B	PS	Coliform.	Pig farm.	Runoff control.

Miles Assessed: 35.5 mi
Miles Supporting Classification: 21.2 mi
Miles Partially Supporting Classification: 4.0 mi

HOOSIC RIVER BASIN (11)

Description of the Watershed

The Hoosic River Basin is located in the northwestern corner of Massachusetts, portions of southwestern Vermont, and mid-eastern portion of the state of New York. The total basin watershed area is 713 square miles of which 165 square miles are in Massachusetts.

The Hoosic River north branch originates in Reedsborough, Vermont and flows in a southerly direction through Stanford, Vermont, Clarksburg, Massachusetts and into North Adams where the north and south branches merge. The south branch begins at the outlet of Cheshire Reservoir (also known as Hoosac Reservoir) in Cheshire and flows in a northerly direction through Adams and into North Adams. The mainstem of the Hoosic River flows northwesterly through North Adams, Williamstown and into Pownal, Vermont. The Hoosic River eventually flows into the Hudson River in the state of New York. The length of the branches in Massachusetts are: north branch 5.0 miles; south branch 16.2 miles; and mainstem 8.3 miles. The major tributary to the Hoosic River is the Green River, which begins in New Ashford and flows northerly to its confluences with the Hoosic River in Williamstown. The Green River is approximately 15 miles in length.

Water Quality Conditions and Trends

Prior to the implementation of a basin-wide wastewater management plan begun in the early 1970's, the Hoosic River was little more than an assimilator and transporter of the basin's wastewaters. The river received untreated wastewater from a number of industries, combined sewer overflows, primary treated effluent from municipal wastewater facilities and untreated sewage discharges from individual residences. Dissolved oxygen levels were significantly depleted, particularly during periods of low flow and high water temperature. Fecal coliform bacteria concentrations were well above those considered safe for primary and secondary contact recreation. Industrial discharges contributed large amounts of oxygen demanding substances, toxic heavy metals, and polychlorinated biphenyls (PCB's). Fish kills were common in the Hoosic River, a visible demonstration of its severely degraded water quality.

During the 1970's and up to the present time, significant and dramatic improvements have been realized in the water quality of the Hoosic River due to upgraded municipal wastewater treatment and the discontinuance of industrial wastewater discharges to the Hoosic River. The City of Adams secondary wastewater treatment facility went into operation in 1971 and the Hoosac Valley Water Quality District (HVWQD) treatment facility went into operation in 1977. The HVWQD facility replaced the outdated facilities in North Adams and Williamstown, expanded the service areas for these communities and connected several industrial discharges into the system. Also several industries closed down, eliminating their discharges to the river. Among those that closed were Arnold Print Works, Widen Tannery and Sprague Electric (greater than 30% reduction in the work force). This action was beneficial to the water quality of the Hoosic River, but very damaging to the local economy.

Water quality surveys were conducted by the Division of Water Pollution Control Technical Services Branch in 1973, 1977, 1978, 1982, and most recently, in 1985. These surveys provided the basis for evaluating the improvement in the Hoosic River and its tributaries. The 1985 surveys demonstrated that the water quality standard for dissolved oxygen ($\geq$ 5.0 mg/l) was exceeded at all locations throughout the survey period. Fecal coliform bacteria levels were within the required criteria except for a portion of the north branch, which receives untreated sewage from a series of domestic residences. This segment needs to have all wastewater discharges connected to the HVWQD facility. The surveys showed very low levels of heavy metals, the absence of PCB's in the water column and the presence of very low levels of PCB's in a restricted area of the mainstem. Overall, the water quality of the Hoosic River is good and reflects significant commitments to proper wastewater management.

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Figure14 HOOSIC RIVER BASIN (11)

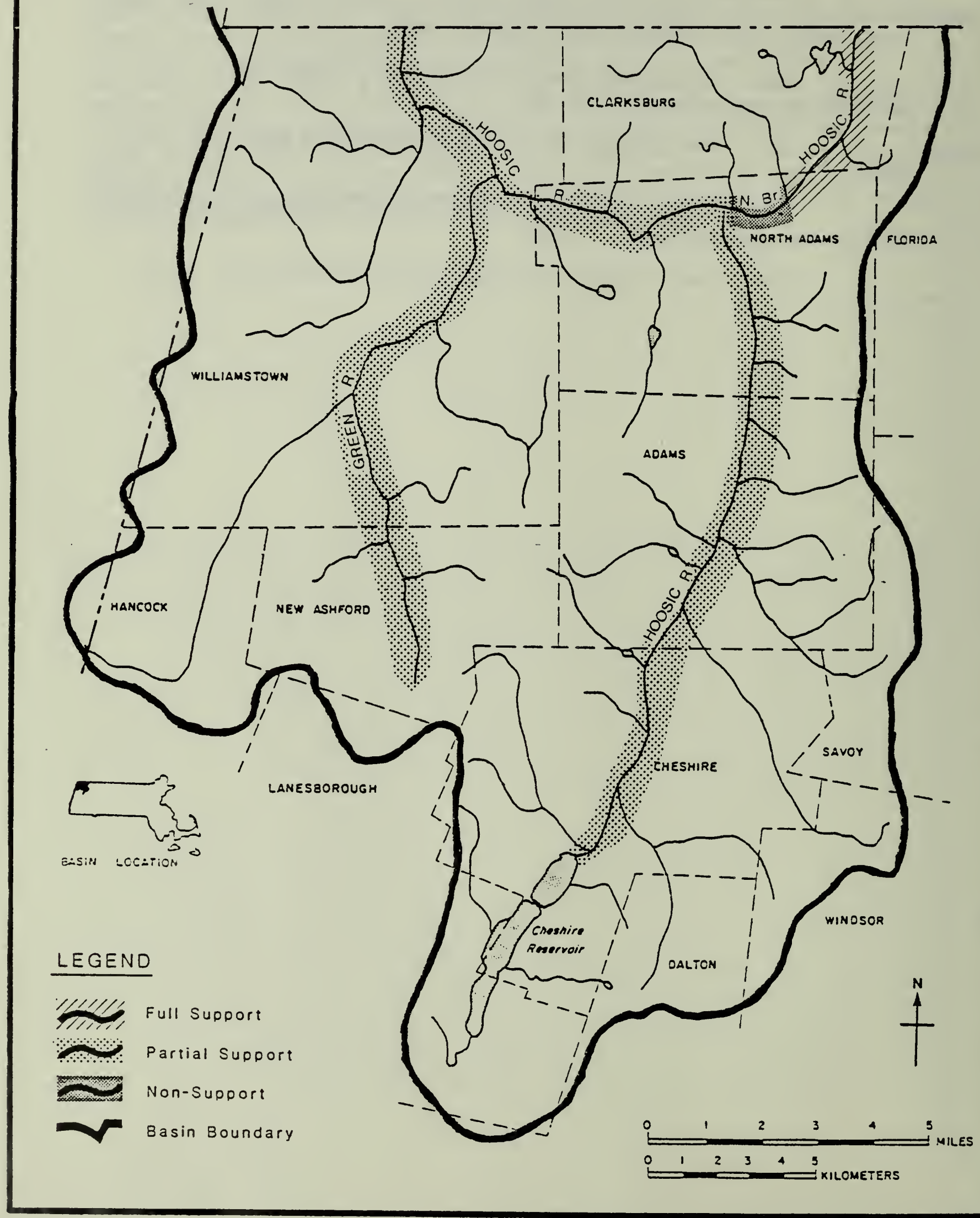

TABLE 24
HOOSIC RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Hoosic River						
North branch from state line to USGS gage, N. Adams	5.6-1.8	B	S	--	--	--
North branch from USGS gage, N. Adams to confluence with south branch, N. Adams	1.8-0.0	B	NS	Fecal coliform.	Untreated domestic discharges.	Connection to HVWQD facility.
South branch from outlet of Cheshire Reservoir to confluence with north branch, N. Adams	21.5-8.3	B	PS	Fecal coliform.	Urban runoff. Subsurface leachate.	Possible corrections to sewerage system.
Mainstem from confluence of north and south branches to state line, Williamstown	8.3-0.0	B	PS	Fecal coliform.	Untreated discharges from north branch. Urban runoff. HVWQD.	Correction of north branch problems; possible corrections to sewerage system. Optimal disinfection at HVWQD.
Green River						
New Ashford to confluence with Hoosic River, Williamstown	10.8-0.0	B	PS	Fecal coliform.	Farm runoff. Possible subsurface.	Best management practices; enforcement of Title V regulations.

Miles Assessed: 37.9 mi
Miles Supporting Classification: 3.8 mi
Miles Partially Supporting Classification: 32.3 mi

HOUSATONIC RIVER BASIN (21)

Description of the Watershed

The Housatonic River is located in the western portion of the states of Massachusetts and Connecticut and the eastern portion of the state of New York. The river flows in a north to south direction, beginning at its headwaters in Hinsdale, Massachusetts and ultimately empting into Long Island Sound in Milford and Stratford, Connecticut. The total drainage area for the entire basin is 1,945 square miles with 545 square miles in Massachusetts. The river is 198 miles long with 69 miles in the Commonwealth.

The Housatonic River is formed by the confluence of the east branch, which originates in the town of Washington, with the west branch which originates at the outlet of Pontoosuc Lake in Pittsfield. The mainstem is joined by several significant tributaries as it flows south including the Green and Williams Rivers and Konkapot Brook. The stream velocity and changes in elevation decrease as the basin expands in southern Massachusetts.

In Massachusetts the basin includes portions of 24 cities and towns with the Pittsfield area being the major population center (60,000). The entire basin population is approximately 120,000 people.

Water Quality Conditions and Trends

The Housatonic River had been subjected to severe degradation for decades from industrial and municipal wastewater, urban runoff and combined sewer overflows. Construction of wastewater treatment facilities and upgrading of existing facilities, which begun in the late 1960's, has resulted in significant improvements to the entire Housatonic River. Advanced wastewater treatment is provided by the Pittsfield WWTP, the largest discharger in the basin, and secondary treatment is provided by facilities in the towns of Lenox, Lenoxdale, Lee, and Great Barrington. Upgraded facilities include the Crane Paper Company in Dalton and at the town of Stockbridge WWTP. Secondary treatment is necessary in the town of W. Stockbridge to achieve adequate water quality in the Williams River.

The Housatonic River has accumulated significant amounts of polychlorinated biphenyls in its sediment, particularly in the area of Woods Pond, from past discharges from the General Electric Company in Pittsfield. An intensive remedial action plan is being developed to retard the migration of PCB's and reduce their occurrence in the water column and stream biota. An advisory warning against consumption of fish from the Housatonic River has been posted by the Massachusetts Division of Fisheries and Wildlife for the entire length of the mainstem. Considerable time and money will be required to restore the river to its desired uses.

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Figure 15 HOUSATONIC RIVER BASIN (21)

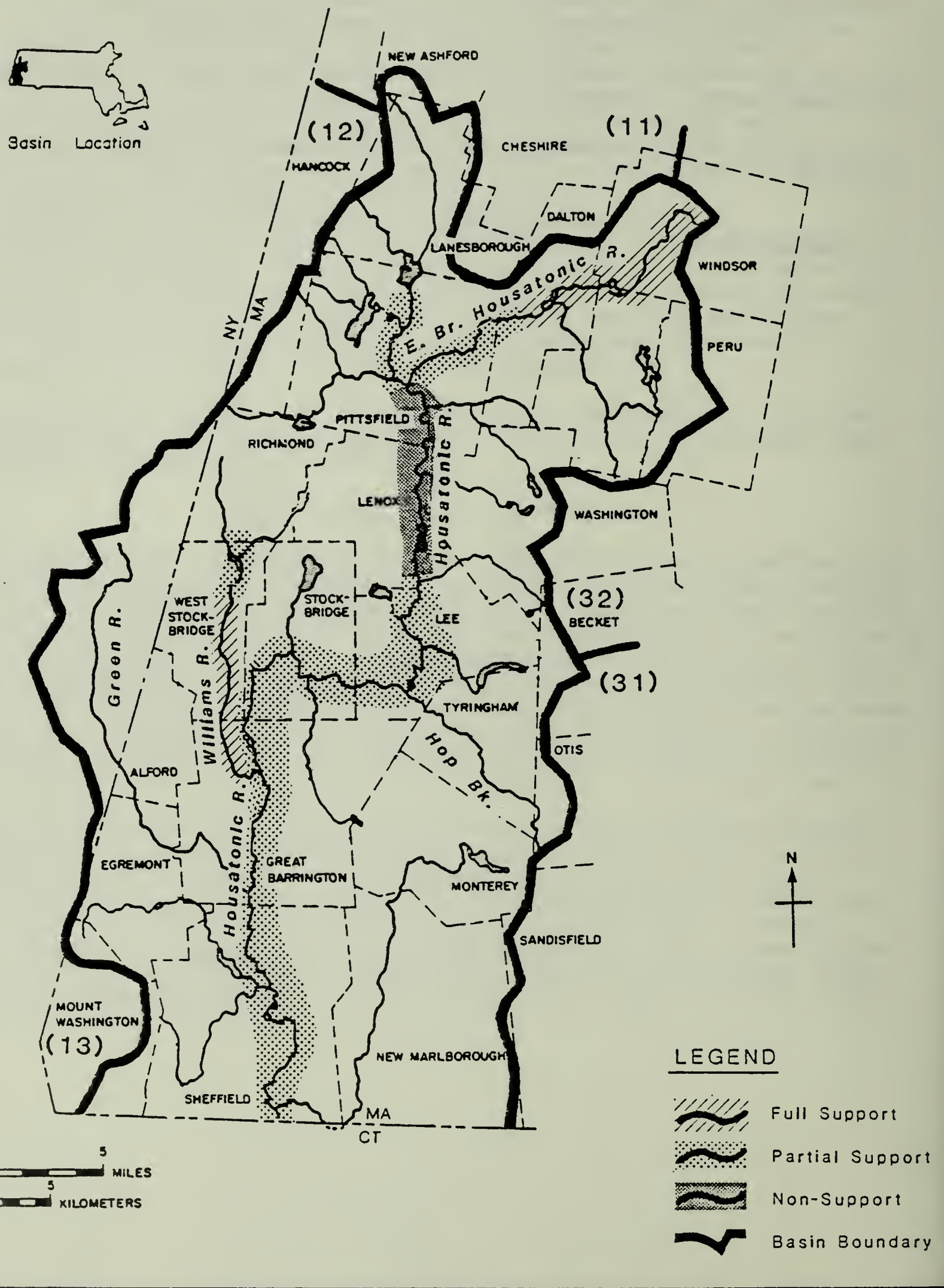

TABLE 25
HOUSATONIC RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Housatonic River						
East branch from Hinsdale to Crane Paper Company, Pittsfield	13.6-5.1	B	S	Possible coliform bacteria.	Sub-surface disposal.	Check Hinsdale sewage disposal practices.
East branch from Crane Paper Company to west branch, Pittsfield	5.1-0.0	B	PS	Dissolved oxygen. Coliform bacteria. PCB's.	Industrial discharges. Urban runoff. Sediment residuals.	Increased waste-water treatment; long term solution to PCB problem.
West branch from source to confluence with east branch, Pittsfield	4.7-0.0	B	PS	Coliform bacteria.	Unknown.	Investigation of coliform sources.
Mainstem from Pittsfield to outlet of Woods Pond, Lee	55.4-45.1	B	NS	Coliform bacteria. Eutrophication. PCB's.	Urban runoff. WWTP's. Sediment residuals.	Improvements to sewer system & WWTP. Long term solution to PCB problem.
Mainstem from outlet of Woods Pond to USGS gage, Great Barrington	45.1-23.9	B	PS	Eutrophication. PCB's.	Urban runoff. WWTP's. Sediment residuals.	Long term solution to PCB problem.
Mainstem from USGS gage to state line, Sheffield	23.9-0.0	B	PS	Eutrophication. PCB's.	Urban runoff. WWTP's. Sediment residuals.	Long term solution to PCB problem.

TABLE 25 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Williams River						
Williams River from source to W. Stockbridge	10.5-8.6	B	PS	Coliform bacteria.	Untreated discharges.	Construction of collection system and WWTP.
W. Stockbridge to confluence with Housatonic River, Great Barrington	8.6-0.0	B	S	--	--	--

Miles Assessed: 84.2 mi
Miles Supporting Classification: 17.1 mi
Miles Partially Supporting Classification: 56.8 mi

IPSWICH RIVER BASIN (92)

Description of the Watershed

The Ipswich River Basin is located in northeastern Massachusetts and encompasses a drainage area of 155 square miles. All or part of nineteen Massachusetts communities lie within the basin. The towns of Middleton, Topsfield, and North Reading lie completely within the basin, as do major portions of Boxford, Hamilton, North Andover, Reading, Wennam, and Wilmington.

The river rises in the town of Burlington and follows a meandering, northeasterly course to the town of Ipswich, where it drains into the Atlantic Ocean. The major tributaries to the Ipswich River are Martins Brook, Boston Brook, Fish Brook and the Miles River.

From its source to its mouth, the Ipswich River experiences a vertical fall of 115 feet, of which approximately 30 feet are taken up by the three dams on the river. At its mouth, the river has a total drainage area of 155 square miles with an average discharge of 249 cubic feet-per-second (cfs) to the Atlantic Ocean. The United States Geological Survey (USGS) maintains two flow gaging stations on the Ipswich River. One is located in south Middleton and the other is located downstream at the Willowdale Dam in Ipswich. The average discharge at the south Middleton gage is 62 cfs, while the average discharge at the Ipswich gage is 187 cfs.

The total stream discharge is affected by several water supply diversions which occur regularly during nigh flow periods and intermittently during low flow periods. Beverly, Lynn, Peabody and Salem divert water from the Ipswich River to augment their water supplies. In addition, twelve other towns have water rights to the Ipswich River.

Water Quality Conditions and Trends

The Ipswich River Basin is a significant water supply source for numerous communities in northeastern Massachusetts. Both groundwater and surface water are utilized, which creates a critical interaction between the two sources. The base flow in the Ipswich River is derived mainly from the groundwater. During conditions of low stream flow, large withdrawals of groundwater can significantly lower the stream flow. On some occassions, groundwater withdrawal has completely depleted surface water flow in the central portion of the river.

Due to the significant demands upon the water resources of the Ipswich River Basin, regulations have been established to protect the river's water quality. The entire freshwater portion of the Ipswich River has been classified as anti-degradation and is subject to Massachusetts Water Quality Standards Regulation 4.3, protection of low flow waters.

Within the boundaries of the Ipswich River Basin there are eleven wastewater dischargers which have NPDES discharge permits. The majority of the discharges are non-contact cooling water and are not considered to cause water quality problems. The town of Ipswich WWTP and Emhart Chemical Group/Bostik Division are the only dischargers in the basin which are classified as major. The

Ipswich WWTP, which discharges to a small tributary to the estuarine portion of the Ipswich River, was upgraded in 1976 and does not create water quality problems. Bostik in Middleton has a permit to discharge cooling water and stormwater only.

The Ipswich River and several of its tributaries are subject to depleted dissolved oxygen levels throughout its freshwater portion in the summer time. The cause is related to the wetland nature of the stream and the associated oxygen demands of the organic matter inherent in wetlands, as well as to the very low oxygen levels of the groundwater replenishing the stream. The condition is not the result of a point source discharge or other man-induced condition and, therefore, it is not a violation of the Commonwealth's water quality standards. The depressed dissolved oxygen levels may create a physiological stress for the aquatic fauna of these waters.

Coliform bacteria samples taken in the tidal portion of the river in Ipswich have been in excess of the Commonwealth's water quality standards. Sources of bacteria may be stormwater runoff, illegal discharges or sewage pipe leakage. However, shellfish harvested in the Ipswich River or in proximal estuarine beds are reported to have very low bacteria counts.

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Figure 16 IPSWICH RIVER BASIN (92)

GEORGETOWN
ROWLEY
(91)
IPSWICH
(84)
Stiles Pond
Lowe Pond
Hood Pond
BOXFORD
Rye Bk.
Ipswich R.
NORTH ANDOVER
Fish Bk.
Norris Bk.
TOPSFIELD
ESSEX
HAMILTON
Miles R.
ANDOVER
WENHAM
MIDDLETON
MANCHESTER
Martins Pond
NORTH READING
(83)
TEWKSBURY
BEVERLY
(93)
WILMINGTON
Martins Bk.
Ipswich R.
DANVERS
Lubbers Bk.
BILLERICA
PEABODY
READING
LYNNFIELD
Maple Meadow Bk.
(71)
WOBURN
BURLINGTON

0 1 2 3 4 5 MILES
0 1 2 3 4 5 KILOMETERS

N

LEGEND

- Full Support
- Partial Support
- Non-Support
- Basin Boundary

TABLE 26
IPSWICH RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
From its source in Wilmington to Sylvania Dam, Ipswich	36.6-4.5	B	S	Dissolved oxygen.	Natural wetland condition.	--
Sylvania Dam, Ipswich to mouth in Ipswich Bay, Ipswich	4.5-0.0	SA	PS	Total coliform bacteria.	Surface runoff. Illegal connections or leakage into Farley Brook, Ipswich. Untreated discharges.	--

Miles Assessed: 36.6 mi
Miles Supporting Classification: 32.1 mi
Miles Partially Supporting Classification: 4.5 mi

THE ISLANDS DRAINAGE BASIN (97)

Description of the Islands

The Islands drainage areas include those of Nantucket, Martha's Vineyard, and the Elizabeth Islands, all located off the southern coast of Cape Cod. These islands collectively exhibit similar geological patterns, water resources, and water quality problems. Ponds constitute the major type of surface freshwater resources and groundwater is the sole source of domestic water supply.

Elizabeth Islands (Dukes County). There are 15 islands in the Elizabeth Island chain, totaling some 8300 acres. The islands are primarily moraine and contain approximately 65 permanent freshwater ponds. Most of the islands are grassy, with areas of low woods or shrub growth. All of the Elizabeth Island chain with the exception of Cuttyhunk and Penikese are owned by one family and managed in a trust. The town of Gosnold, which is located on Cuttyhunk, is the island chain's only year-round community.

Martha's Vineyard (Dukes County), is an island consisting of 6 towns with a total surface area of 105.9 square miles, 125 miles of coastline and a maximum elevation of 130 feet. It is the largest island off the coast of New England. The island's topography is extremely varied ranging from wide barrier beaches, coastal brackish ponds, outwash plains, rolling moraines and coastal scarpments. This diverse topography, with productive waters and proximity to bird migration routes, provides favorable habitat for a wide range of wildlife.

The Vineyard's water supply depends solely on several groundwater aquifers with rainfall as the only replenishing source.

Nantucket Island (Nantucket County), is an island comprising 49.5 square miles, 94 miles of coastline and a maximum elevation of about 100 feet. The island's glacial history has led to a mix of landforms including outwash plain, moraine, ponds and marshes. Soil composition is primarily silty sand, loam, peat and marsh with extensive sand deposits along the shoreline. In 1975 the entire island was included in the National Register because of the unique architecture and its historical value. In addition all of the island's have been included under the Commonwealth's Ocean Sanctuaries Statutes, which prohibit the removal of sand or gravel, dumping, or new discharges of wastes.

Water Quality Conditions and Trends

All of the islands, but most particularly Martha's Vineyard, Nantucket and Cuttyhunk, experience large influxes of tourists during the summer months. These seasonal population booms place particular burdens on each island's limited water supply and waste disposal facilities.

With the summer resident population of Nantucket rapidly approaching 30,000, and an additional 500,000 tourists visiting each year, there are potential threats to surface water quality and groundwater. Potential impacts are from septic system leachate, landfill disposal of septage and solid wastes, and saltwater intrusion. Coastal waters are threatened by possible oil spills from tanker traffic and by sanitary waste discharges from watercraft, particularly those moored in harbors.

There are no industrial wastewater discharges on Nantucket. A thermal discharge to Nantucket Harbor presently meets water quality standards. At the present time the island utilizes two sand beds for sanitary waste treatment. The town of Nantucket has recently upgraded the Sea St. Pumping Station there by eliminating the occassional bypass of sewage into the harbor.

Potential water quality proolems on Martha's Vineyard are similar to those on Nantucket and are related to heavy use of septic systems, landfill leachate, watercraft waste, stormwater runoff, and oil spillage. Presently there are two sanitary wastewater treatment plants on Martha's Vineyard, one of which discharges to a sand filter and the other to a leaching field.

The towns of Tisbury and Oak Bluffs have recently notified the Commonwealth of their interest in developing municipal treatment facilities and both are in the initial facilities planning stages.

The island of Cuttyhunk in the town of Gosnold has two small untreated discharges to Vineyard Sound. The provisions of the Federal Clean Water Act PL 92-500 as amended in 1977 requires the town to upgrade these facilities to secondary treatment levels or seek a waiver through the 301(h) waiver proceedings contained in that law. The town is currently pursuing such a waiver and is awaiting a decision on its request from the EPA Region I office.

The existing data indicate that the freshwater resources of the islands to be generally of high quality. Problems, as described above are associated with non-point sources. The most sensitive use of coastal waters other than for fish and wildlife propagation, is shellfish harvesting. The majority of shellfish bed closures are due to bacterial contamination. The data base was established for all of the islands during the mid 1970's and needs to be updated.

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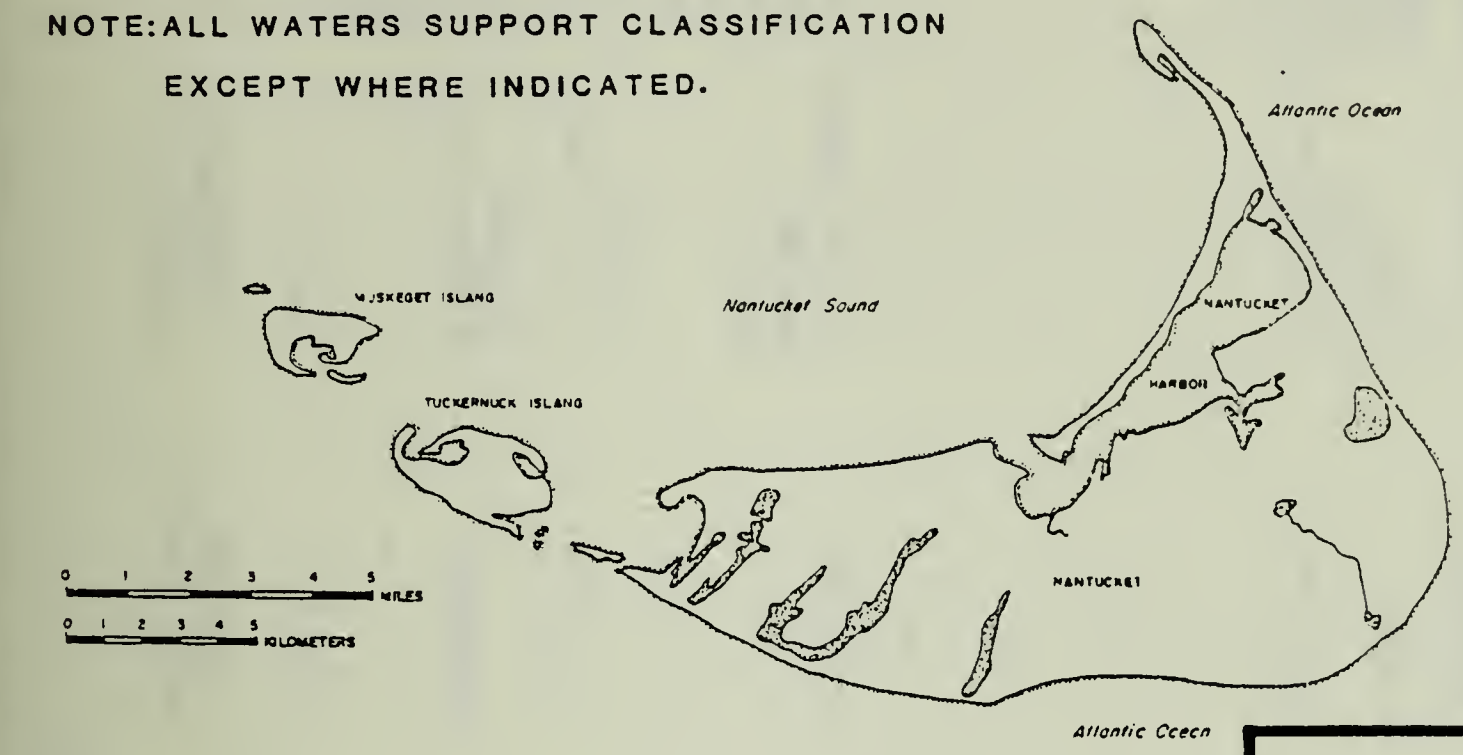
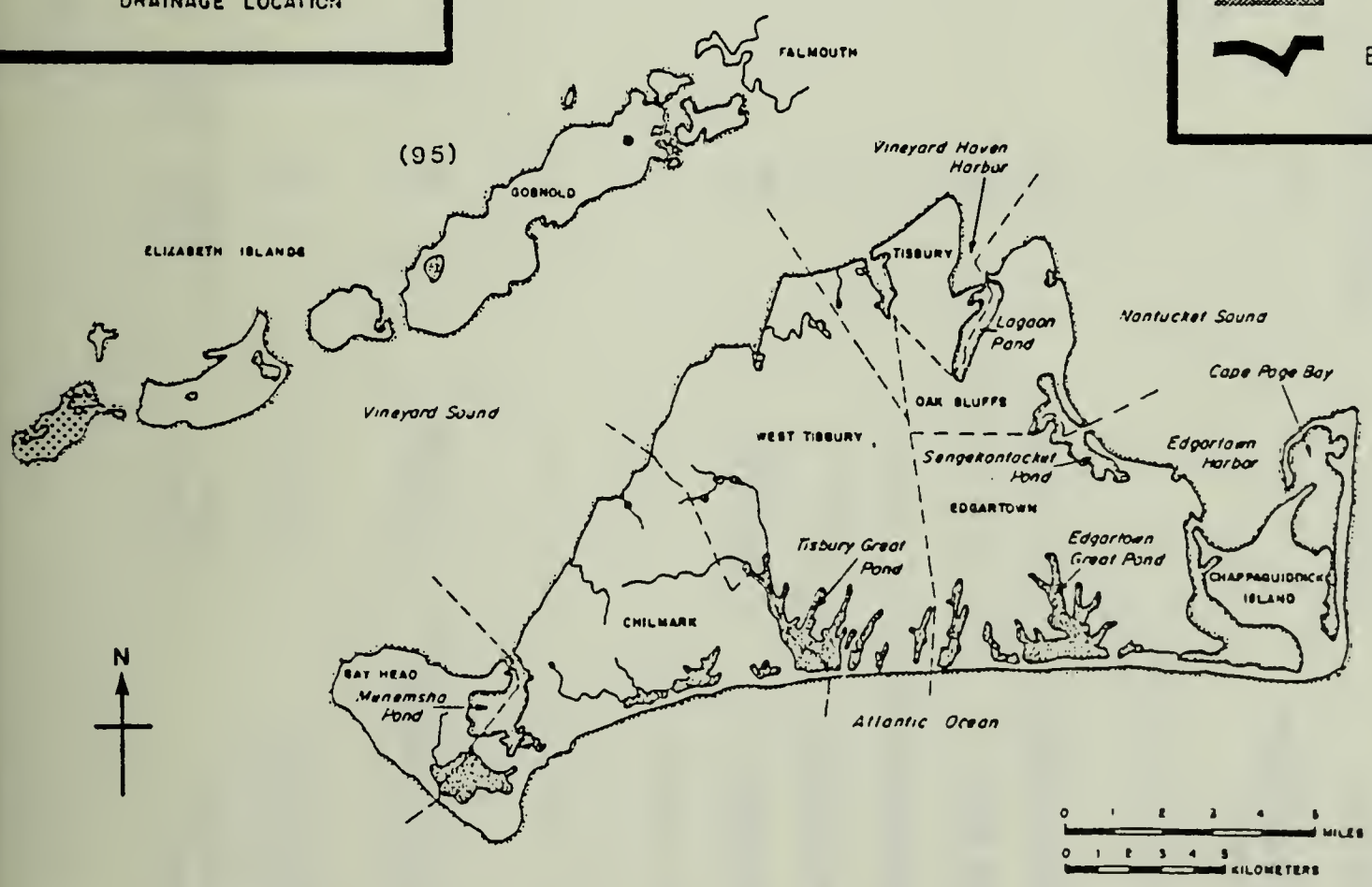
Figure 17 ISLANDS BASIN (97)

NOTE: ALL WATERS SUPPORT CLASSIFICATION EXCEPT WHERE INDICATED.



LEGEND

- Full Support
- Partial Support
- Non-Support
- Basin Boundary



NOTE: ALL WATERS SUPPORT CLASSIFICATION EXCEPT WHERE INDICATED

TABLE 27
THE ISLANDS DRAINAGE BASIN

SEGMENT DESCRIPTION	SQUARE MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Nantucket Harbor	7.65 mi^2	SA	S	Coliform.	Boats.	Improve pump out facilities at marinas; sealed head bylaws.
Sesachacha Pond	--	SA	S	--	--	--
Coskata Pond	--	SA	S	--	--	--
Great Point Pond	--	SA	S	--	--	--
Chilmark Pond	0.18 mi^2	SA	S	--	--	--
Menemsha Pond	0.99 mi^2	SA	S	Coliform.	Failing septic systems. Boats.	Proper maintenance of subsurface disposal. Improve pump out facilities. Sealed head bylaws.
Oak Bluffs Harbor	0.05 mi^2	SA	S	Coliform.	Boats.	Improve on-shore pump out facilities.
Cape Poge Bay	2.24 mi^2	SA	S	--	--	--

TABLE 27 (CONTINUED)

SEGMENT DESCRIPTION	SQUARE MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Vineyard Haven Harbor	2.60 mi^2	SA	S	Coliform.	Boats.	Improve on-shore pump out facilities.
Sengekontacket Pond	1.57 mi^2	SA	S	Coliform.	Failing septic systems.	Septic system maintenance.
Lagoon Pond	0.75 mi^2	SA	S	Coliform.	Failing septic systems.	Septic system maintenance.
Lake Tashmod	0.36 mi^2	SA	S	--	--	--
Oyster Pond	0.19 mi^2	SA	S	--	--	--
Mattakeset Bay	--	SA	S	--	--	--
Edgartown Harbor	1.09 mi^2	SA	S	--	--	--
Katama Bay	2.60 mi^2	SA	S	--	--	--
Edgartown Great Pond	1.30 mi^2	SA	S	--	--	--
Tisbury Great Pond	--	SA	S	--	--	--
Cuttyhunk, Cutyhunk Pond		SA	PS	Coliform.	Failing septic systems. Boats.	Tie into municipal treatment facility. Sealed head bylaw.
West End Pond	--	SA	S	--	--	--

Square Miles Assessed: 21. 57 mi^2
Square Miles Supporting Classification: 21.57 mi^2
Square Miles Partially Supporting Classification: 0 mi^2

MERRIMACK RIVER BASIN (84)

Description of the Watershed

The Merrimack River is formed in Franklin, New Hampshire at the confluence of the Pemigewasset and Winnipesaukee Rivers. It flows southward for 78 miles through the central portion of New Hampshire and into Massachusetts. Near the city of Lowell, Massachusetts the river turns to the northeast and flows 38 miles to the city of Newburyport where it empties into the Atlantic Ocean. The Merrimack River drainage basin, fourth largest in New England, is comprised of a total of 5,010 square miles in New Hampshire and Massachusetts. Only 24 percent, or approximately 1,200 square miles, of the watershed is located within the Commonwealth of Massachusetts.

From the state line to the Merrimack estuary, a distance of 50 miles, the river drops 90 feet in elevation. This drop includes flow over major dams in the cities of Lowell and Lawrence which also marks the location of significant flow diversions through extensive canal systems. The United States Geological Survey (USGS) maintains a flow monitor on the Merrimack River at Lowell. The average discharge at this gage over 10 years of record is 7,529 cubic feet per second (cfs) and the seven-day, ten-year low flow is approximately 930 cfs.

Major sub-watersheds within the Massachusetts portion of the Merrimack River drainage basin are the Nashua (530 mi^2), Stony Brook (51 mi^2), SuAsCo (406 mi^2), and Shawsheen (72 mi^2). Other smaller tributaries include Beaver Brook, Spicket River, Little River, and Powwow River.

The maximum length of the Merrimack estuary is nine miles. It drains a total of 4,208 acres of salt marsh. The surface area of the estuary at mean low water is 3.29 mi^2. At mean high water the surface area is 6.18 mi^2 and the total volume is 1.884×10^9 cubic feet. The effects of the ocean tides extend 22 miles upstream to Haverhill.

Water Quality Conditions and Trends

For many years prior to the late 1970's the water quality of the mainstem Merrimack's River in Massachusetts was adversely impacted by a number of pollution sources. These included large volumes of untreated sewage that were released to the river in the cities of Lowell, Lawrence, and Haverhill, and the addition of contaminants from polluted tributaries such as the Nashua River which flows into the Merrimack River in Nashua, New Hampshire. An estimated BOD_5 loading of from 65-75 thousand pounds per day was discharged directly to the Merrimack from the three cities mentioned above.

Despite heavy organic loadings to the river from the larger cities in New Hampshire and Massachusetts, the Merrimack River did not exhibit severe dissolved oxygen depletion during most times of the year primarily due to the large amount of flow that served to dilute incoming wastes. During summer months when flow in the river was much lower, dissolved oxygen concentrations violated water quality standards. Furthermore, concentrations of plant nutrients such as nitrogen and phosphorus, and coliform bacteria counts were high. The presence of elevated concentrations of nitrogen and phosphorus in the water contributed to a significant diurnal dissolved oxygen fluctuation.

One of the most devastating impacts resulting from water quality degradation of the Merrimack River was destruction of the shellfish industry located in the estuary. A report published jointly by the Massachusetts Department of Environmental Quality Engineering (MDEQE) and the Merrimack Valley Planning Commission describes the tidal flats of the Merrimack River Estuary and presents a historical record of their annual production. The flats comprise a total of over 850 acres which, at the turn of the century, were yielding almost 100,000 bushels of soft shell clams annually. Worsening water quality conditions in the Merrimack River led to closure of some shellfish flats as early as 1925. By the 1950's and 60's annual production had decreased to a few hundred bushels, making the shellfish industry virtually non-existent in the Merrimack estuary.

By the early 1960's, poor water quality conditions were severely limiting the beneficial uses of the Merrimack River. As a result, a program was initiated to ameliorate water pollution problems in the river. Environmental legislation such as the Federal Water Pollution Control Act provided funding for the construction of municipal wastewater treatment facilities and the elimination of direct river discharges of untreated sewage or industrial wastes. Today, secondary wastewater treatment facilities are operating in Lowell, Lawrence, Haverhill, Amesbury, Newburyport and Merrimac. BOD_5 loadings from Lowell, Lawrence, and Haverhill are estimated to have been reduced by 80% from earlier loadings. Construction of a treatment facility will soon begin in the town of Salisbury.

Water quality improvements resulting from the construction of wastewater treatment facilities are readily apparent upon examination of 1979, 1981 and 1985 water quality survey data. Dissolved oxygen content in the river is now considerably better than in past years. Furthermore, coliform bacteria counts have decreased significantly in segments of the river immediately downstream from urban areas.

Today, some shellfish beds in the Merrimack River estuary are being harvested on a restricted seasonal basis. Even further improvements should result from the recent upgrading of the Newburyport WWTP.

Water quality problems do still exist in the Merrimack River. Whereas oxygen demand has been drastically reduced, nutrients are still present in concentrations which promote the growth of phytoplankton. Nitrogen and phosphorus from upstream sources concentrate in the impoundment behind the Essex Dam in Lawrence, causing algal blooms in the summer months. A characteristic diurnal dissolved oxygen fluctuation occurs throughout much of the river. The major sources of pollution today in the lower Merrimack River are combined sewer overflows (CSO) in the old urban centers of Lowell, Lawrence and Haverhill. In addition, untreated sewage is released to the Merrimack River in portions of Lowell that still remain to be connected to the new wastewater treatment plant at Duck Island. The CSO and untreated discharges are indicated mainly by high coliform bacteria counts downstream from the three aforementioned cities. Bacteria levels steadily decrease downstream from the city of Haverhill due to both natural die-off and dilution. Despite the existence of a number of local sources of pollution around the Merrimack Estuary, such as sewage loadings to Black Rock Creek in Salisbury, the impacts on water quality of pollutants originating upstream are lessened by the flushing action of the tides. More attention will be given, in upcoming water quality surveys to identify and quantify pollutants originating upstream of the Massachusetts border in New Hampshire.

Major tributaries to the Merrimack River in Massachusetts are the Nashua, Shawsheen and Concord Rivers and Stony Brook, which are treated in separate sections of this report. Smaller tributaries for which water quality data are available are described below.

High coliform bacteria levels are exhibited in Beaver Brook in Lowell. They are the result of wastewater discharges in Dracut and Lowell. Dissolved oxygen depletion, however, is minimized by the reaeration characteristics of Beaver Brook.

The Spicket River exhibits severe dissolved oxygen depletion, elevated bacteria counts, and increased nutrient levels from municipal and industrial discharges in Salem, New Hampshire and Lawrence, Massachusetts.

Due to its low flow characteristics and many wastewater discharges, the Little River (Haverhill) exhibits extreme water quality problems. At times dissolved oxygen concentrations fall to 0.0 mg/l just upstream from the confluence with the Merrimack River. Solids content, turbidity, and color values are often very high.

Class B standards violations occur in the Powwow River as the result of urban runoff and municipal and industrial discharges in Amesbury center. The town is currently studying inflow and infiltration problems in their sewage system to help eliminate excessive flow rates to the WWTP.

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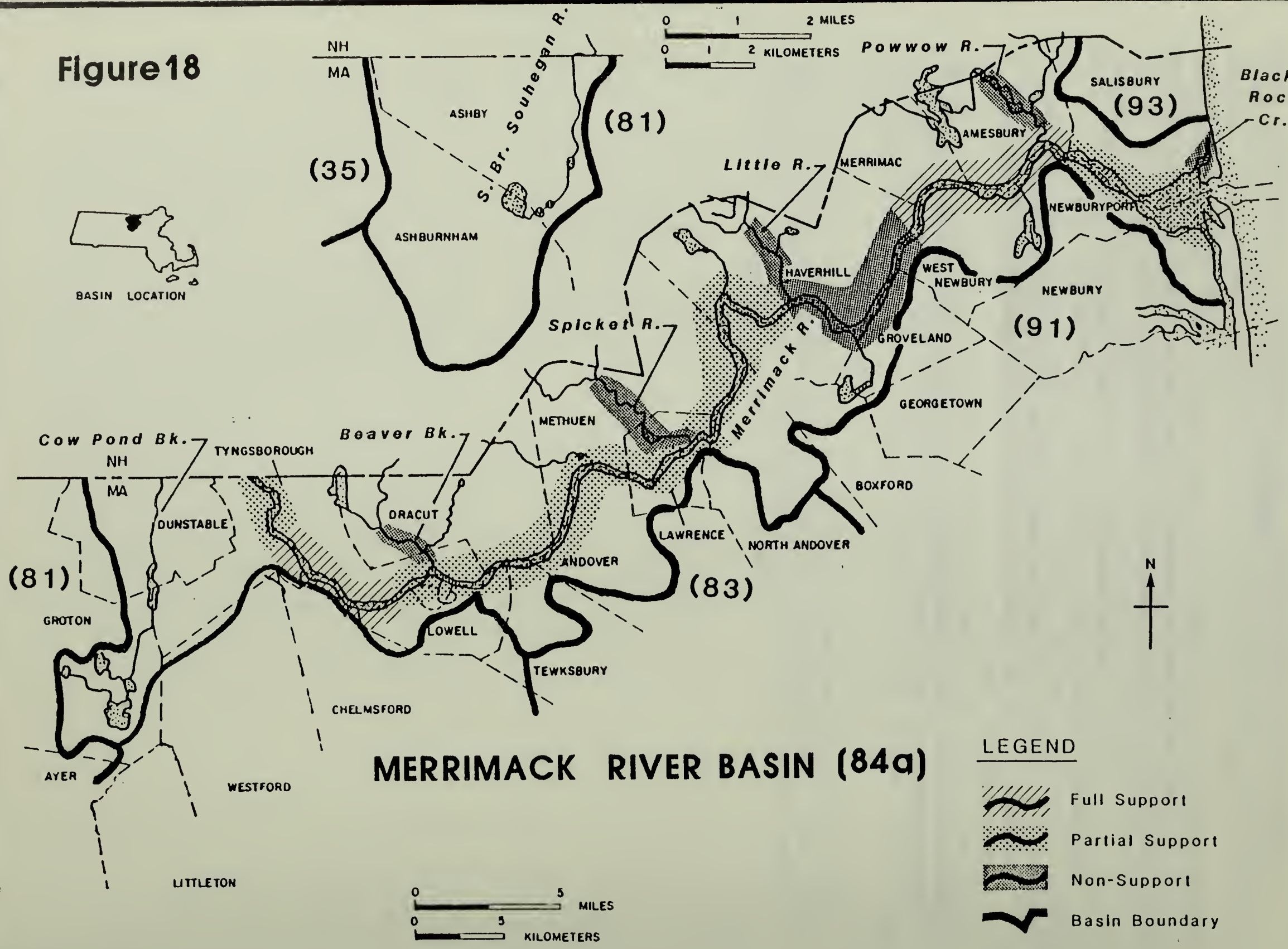
Figure 18



MERRIMACK RIVER BASIN (84a)

LEGEND

- Full Support
- Partial Support
- Non-Support
- Basin Boundary

TABLE 28
MERRIMACK RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Merrimack River						
Mass.-NH line to Tyngsborough Bridge, Tyngsborough	49.8-47.4	B	PS	Fecal coliform bacteria.	N.H. discharges. Nashua River.	City of Nashua WWTP upgrading from primary to secondary treatment. Design is complete. Expected plant completion in 1990.
Tyngsborough Bridge to Pawtucket Dam, Lowell	47.4-40.6	B	S	--	--	--
Pawtucket Dam to Essex Dam, Lawrence	40.6-29.0	B	PS	Fecal coliform bacteria.	Surface runoff. Combined sewer overflows and untreated discharges in Lowell.	Limited planning and specification work has begun on combined sewer overflow abatement in Lowell. Dry weather flows to be tied in by early 1987.
Essex Dam to Little River, Haverhill	29.0-21.9	B	PS	Fecal coliform bacteria.	Upstream discharges. Surface runoff. Combined sewer overflows in Lawrence.	Combined sewer overflows to be eliminated pending adequate funding. Spicket River Interceptor to be tied in to Lawrence WWTP. Expected completion in 1988.

TABLE 28 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Little River to Rocks Bridge, Haverhill-West Newbury	21.9-11.8	SB	PS	Fecal coliform bacteria.	Surface runoff. Upstream discharges. Combined sewer overflows in Haverhill.	Combined sewer overflows to be eliminated pending adequate funding. Little River Interceptor study has been funded.
Rocks Bridge to Routes 1 and 1A Bridge, Newburyport	11.8-3.0	SB	S	--	--	--
Routes 1 and 1A Bridge to the Atlantic Ocean, Newburyport	3.0-0.0	SB	PS	Fecal coliform bacteria.	Untreated wastewater discharges in Salisbury.	Plans and specifications complete for Salisbury secondary WWTP. Construction grant made.
Beaver Brook, Mass. portion, Lowell	4.2-0.0	B	NS	Fecal coliform bacteria.	Urban runoff. Untreated discharges in Lowell.	Tie in Beaver Brook discharges to Lowell WWTP. Expected completion early in 1987.
Spicket River, Mass. portion, Lawrence	6.4-0.0	B	NS	Fecal coliform bacteria. Dissolved oxygen. Phosphorus.	Untreated discharges in Salem, NH, and Lawrence. Industrial discharge.	Spicket River Interceptor to tie in to Greater Lawrence WWTP. Expected completion in 1988.

TABLE 28 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Little River, Mass. portion, Haverhill	4.3-0.0	B	NS	Dissolved oxygen. Solids. Fecal coliform bacteria.	Untreated discharges in Plaistow, NH and Haverhill. Combined sewer overflows in Haverhill.	Little River improvements. Preliminary planning to be completed 12/85 for Little River Interceptor CSO and pretreatment.
Powwow River, Mass. portion, Merrimac	6.4-0.0	B/SB	NS	Fecal coliform bacteria.	Untreated discharges in Amesbury center. Urban runoff.	Sewage systems expansion and improvement in Amesbury.
Black Rock Creek, entire length, Salisbury	1.7-0.0	SB	NS	Dissolved oxygen. Fecal coliform bacteria. Solids.	Untreated and partially treated municipal discharges in Salisbury.	Salisbury has recently been awarded a construction grant to fund a WWTP.

Miles Assessed: 72.8 mi
Miles Supporting Classification: 15.6 mi
Miles Partially Supporting Classification: 34.2 mi

MILLERS RIVER BASIN (35)

Description of the Watershed

The Millers River Basin is located in north central Massachusetts and south eastern New Hampshire. The river is formed in Winchendon, Massachusetts by the confluence of the north and main branches. The river travels in a westward direction through the communities of Templeton, Royalston, Athol, Orange, Erving, and Montague. The confluence of the Millers River with the Connecticut River is in Gill. The total drainage area of the Millers River is 390 square miles, of which 350 square miles are in Massachusetts. The average flow of the Millers River at its confluence with the Connecticut River is 620 cfs.

Major tributaries of the Millers River are the Otter River, which joins the Millers in Winchendon, and the Tully River, which joins the Millers in Athol. The Tully and Millers Rivers have been considered potential sources of water supply.

The watershed of the Millers River is very hilly, and contains many tracts of forested land. The basin is mostly rural, with areas of moderate development. The population of the Millers River Basin is approximately 57,000. The major industries of the region are located in the larger towns of Athol and Orange, and in the city of Gardner. Traditionally, paper products, furniture, and tool making have been the major industries in the basin. In recent years, however, many of these companies have relocated or gone out of business. Some of the Commonwealth's highest unemployment levels are currently experienced in this region.

Water Quality Conditions and Trends

Segments of the Millers River and the Otter River were among the most severely polluted river reaches in the Commonwealth during the 1960's and through the mid 1970's. Although problems still exist in some areas, the overall water quality in the basin has improved greatly. Most of the Millers River meets class B water quality standards. Improvements have resulted from the construction of a number of treatment facilities in the basin including the Erving, Millers Falls, Royalston, and Templeton wastewater treatment plants. In addition, two new treatment facilities have come on line in the past year in Farley and at the Fernald State School.

The remaining water quality problems of the Millers River are continued to three river segments. Combined sewer discharges from Winchendon cause elevated bacteria levels in the river. Water quality below the Otter River is degraded due to the poor quality of the Otter River water. The Millers River below the Erving WWTP has high solids levels, due to operational problems at the Erving plant.

The entire length of the Otter River has periodic violations of the standard for dissolved oxygen, and has high nutrient levels. Water quality problems above the first discharge, the Gardner WWTP, are caused by natural conditions, whereas downstream problems are caused by the large volume of wastewater being released by three treatment facilities to a small stream with a low assimulative capacity. The existing water quality of the Otter River will be improved by two abatement projects. The Gardner WWTP is currently being upgraded to advanced treatment, and Seaman Paper Company will provide biological treatment for its paper wastes.

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Figure 19 MILLERS RIVER BASIN (35)

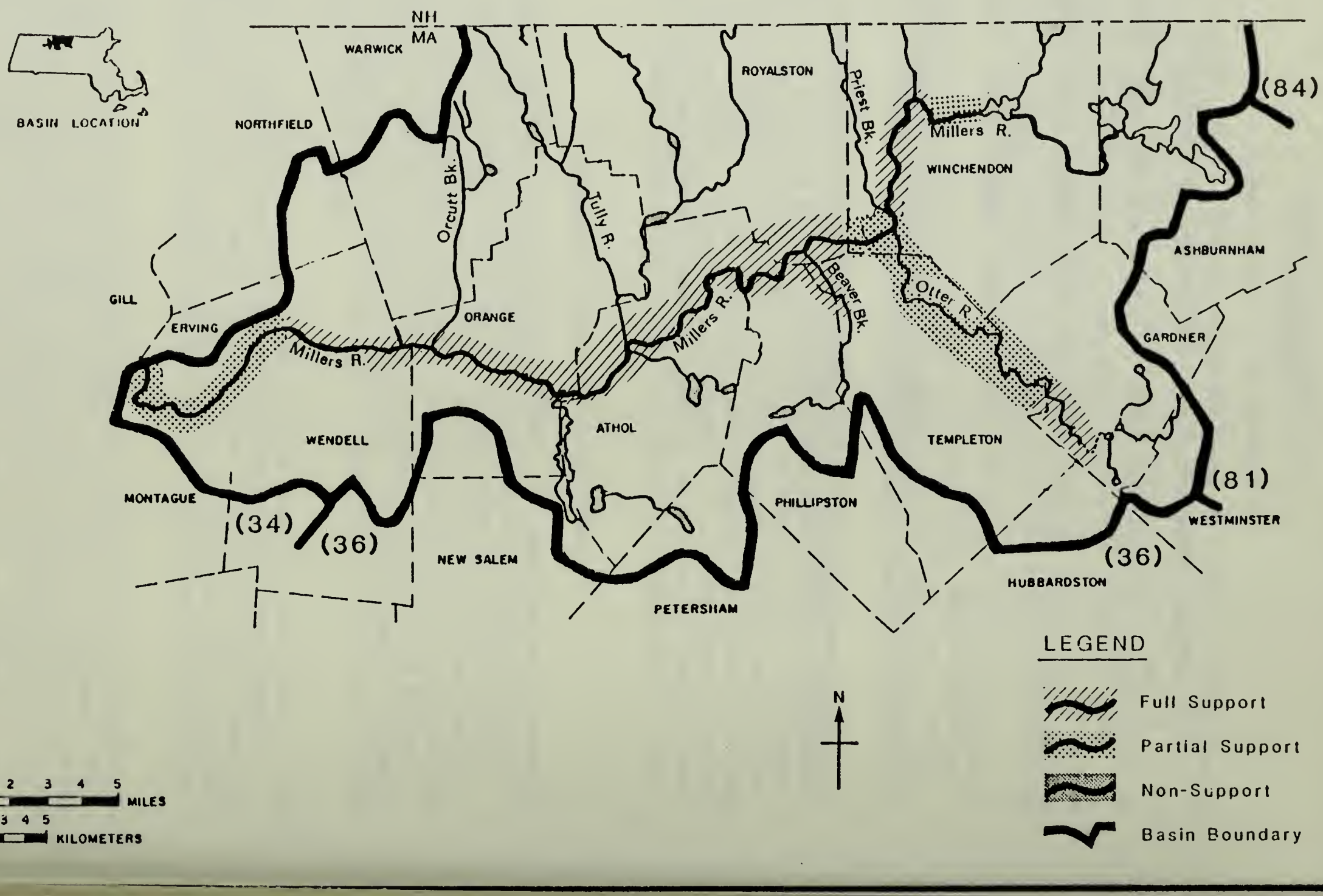

TABLE 29
MILLERS RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Millers River						
Above Winchendon WWTP, Winchendon	above 35.7	B	PS	Coliform bacteria.	CSO's in Winchendon.	Control CSO's in Winchendon.
Winchendon WWTP to Otter River, South Royalston	35.7-30.4	B	S	--	--	--
Otter River to South Royalston USGS Gage, South Royalston	30.4-25.6	B	PS	Dissolved oxygen. Solids. Nutrients.	Otter River.	Upgrade treatment at discharges to Otter River.
South Royalston USGS Gage to Erving Paper Company, Erving	25.6-8.1	B	S	--	--	--
Erving Paper Company to confluence with Connecticut River, Erving	8.1-0.0	B	PS	Solids.	Operational problems at Erving Paper Co.	Eliminate operational problems.
Otter River						
Source to Gardner WWTP, Gardner	12.2-9.6	B	S	Dissolved oxygen.	Naturally occurring low D.O. due to wetlands.	--
Gardner WWTP to confluence with Millers River, Winchendon	9.6-0.0	B	PS	Dissolved oxygen. Nutrients. Solids.	Gardner WWTP. Seaman Paper Co.	Advanced treatment at Gardner. Biological treatment at Seaman Paper.

TABLE 29 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Beaver Brook						
Fernald School discharge to Millers River, Royalston	3.1-0.0	B	S	--	--	--

Miles Assessed: 51.0 mi
Miles Supporting Classification: 28.5 mi
Miles Partially Supporting Classification: 22.5 mi

MOUNT HOPE BAY DRAINAGE BASIN (61)

Description of the Watershed

Mount Hope Bay is located at the outlet of the Taunton River and is part of the Naragansett Bay. This area encompasses sections of the towns of Rehoboth, Swansea, Dighton, Somerset, Fall River and Westport. The Lee and Coles River typically have low flows due to their small drainage areas and both are subject to tidal influences.

Water Quality Conditions and Trends

Fall River is a large industrialized community that has an extensive sewer system and a high volume wastewater treatment facility. Construction to expand and upgrade the primary treatment plant discharging to Mount Hope Bay was completed in 1983, which reduced organic loadings from the plant by approximately 80 percent. A sampling program will be planned in the near future to document any improvements in water quality. However, violations of class SB water quality criteria for bacteria have consistently occurred due to combined sewer overflows (CSO) to Mount Hope Bay and the Quequechan River. These violations occur during both wet and dry weather flows. Fall River has completed a facility plan to study the CSO problem. The completion of this project has been delayed by the city of Fall River.

The Lee and Cole Rivers in Swansea have experienced water quality problems due to excess fecal coliform bacteria counts, especially after storm events. The bacteria originate from failing subsurface disposal systems. The high levels of bacteria have caused conditional and total closures of shellfish beds in the estuary of these rivers.

The publication of water quality data, water quality analysis reports, and a water quality management plan for Mount Hope Bay have been included in the Taunton River Basin. These reports include reference to Mount Hope Bay.

REFERENCES

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Figure 20

MOUNT HOPE BAY DRAINAGE AREA (61)

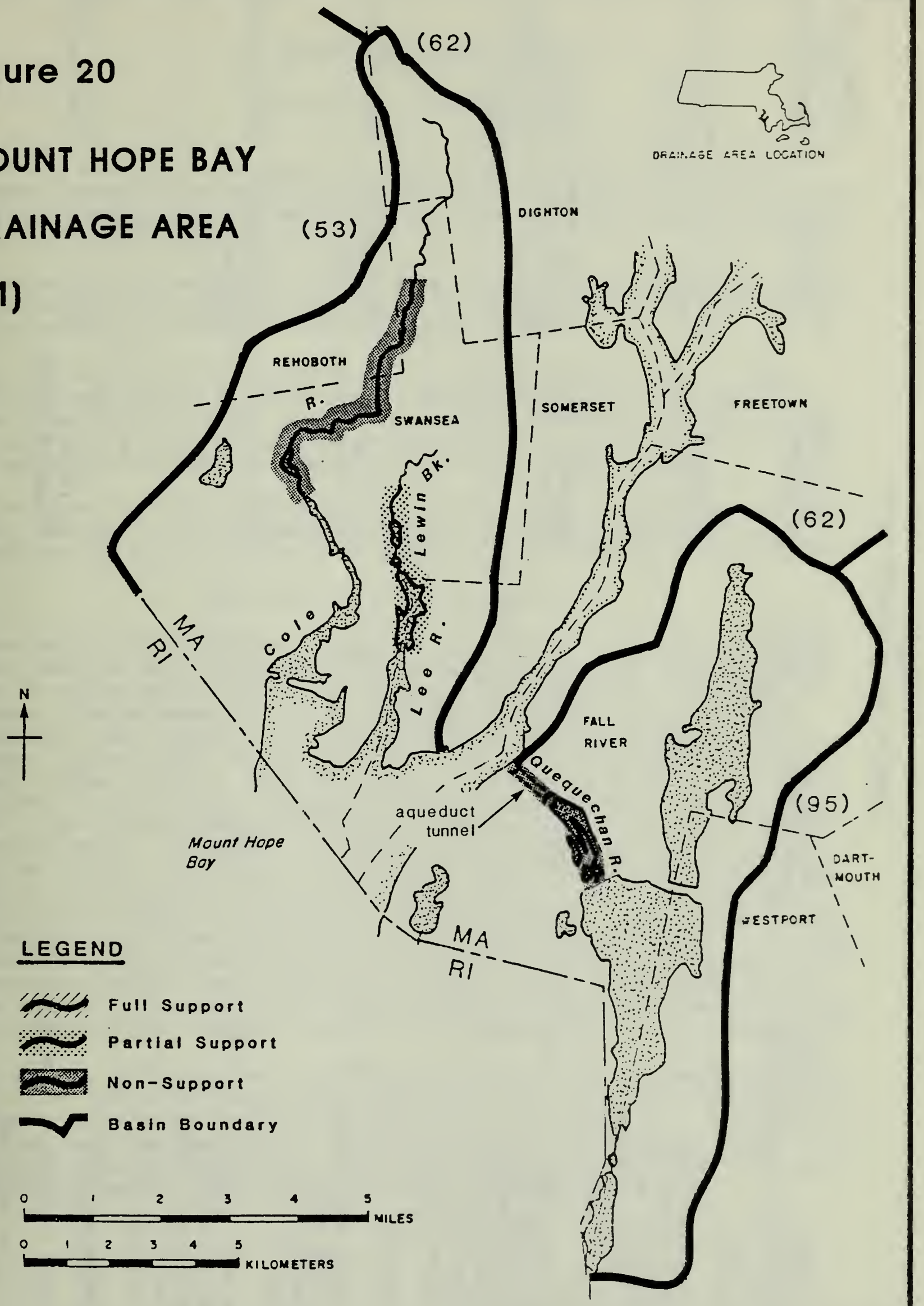

TABLE 30
MOUNT HOPE BAY DRAINAGE BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Lee River						
Lewin Brook from Gardner's Neck Rd., Swansea to Route 103 bridge on Wilbur Ave., Swansea	3.2-1.9	B	PS	Coliform. Dissolved oxygen.	Failing septic systems.	Facilities plan to study problem.
Estuary, Route 6 Fall River Rd., Swansea/Somerset to Route 103 Wilbur Ave., Swansea/Somerset	1.9-1.4	SB	PS	Coliform. Dissolved oxygen.	Failing septic systems. Urban runoff. CSO's.	Facilities planning to study problems and eliminate CSO's.
Cole River						
Wood Street bridge to Fall River Road (Rt. 6), Swansea	5.0-3.6	B	NS	Coliform. Dissolved oxygen.	Failing septic systems.	Same as above.
Estuary, from Fall Rd. (Rt. 6) to Wilbur Ave. bridge (Rt. 103) Swansea/Somerset	3.6-1.9	SB	NS	Coliform	Failing septic systems. CSO's.	Same as above.
Quequechan River						
Route 6 bridge, outlet to South Watuppa Pond, Fall River to Veaduct St. bridge, at Battleship Cove, Fall River	2.3-0.0	B	NS	Coliform. Dissolved oxygen.	CSO's.	Eliminate CSO's.

Miles Supporting Classification: 0 mi

MYSTIC RIVER BASIN (71)

Description of the Watershed

The Mystic River drains 69 square miles and is 17 miles in length. It runs through a watershed characterized by a high degree of urbanization in the north section of Greater Boston. Much of the basin is highly developed with considerable industrial and commercial activity.

The headwaters of the Mystic include the Aberjona River and Hall's Brook. Horn Pond Brook in Woburn, Mill Brook in Arlington, and Alewife Brook in Camoridge all contribute to the flow of the middle Mystic River.

Upper and Lower Mystic Lakes are found in the middle basin. They are both used for recreation on a limited basis. Nutrients supplied by the Aberjona River cause the Upper Mystic Lake to be eutrophic. Lower Mystic Lake to the south, is fed by Upper Mystic Lake and Mill Brook. In 1966, the Amelia Earhart Dam was built to prevent salt water intrusion into the lower lake.

The outlet of the Lower Mystic Lake is recognized as the beginning of the Mystic River. It flows in a southeasterly direction, is joined by the Malden and Chelsea rivers, and is eventually discharged to Boston Harbor.

Water Quality Conditions and Trends

Severe water quality problems continue in the Aberjona River, which affect the Mystic River as well. Toxic chemicals and ammonia leach into the Aberjona River in Woburn and Wilmington from abandoned disposal sites and chemical lagoons. Combined sewer overflows in Stoneham contribute to the coliform violations. The Aberjona River experiences problems with elevated levels of mercury, lead and zinc, as well as excess coliforms, and violates the relevant class B stream criteria. "Horn Pond Brook," although not a clean water stream, does meet class B standards and provides significant dilution to the Aberjona River. Upper Mystic Lake has experienced continued degradation of water quality in recent years. Lower Mystic Lake suffers from trapped saline water in the hypolimnium and it is a highly eutrophic lake due to nutrient loading from the Aberjona River. Although the quality of Mill Brook is better than that of the Mystic Lakes (except for the high fecal coliform levels) it does not meet class B standard and provides little relief to the lakes through dilution. The length of the Mystic River from Lower Mystic Lake to the Amelia Earhart Dam generally experiences a steady rise in BOD_5 and suspended solids. DWPC surveys of the tidal portion of the Mystic River in 1983 recorded violations of the SC standard for dissolved oxygen although total coliform concentrations were satisfactory.

In Cambridge, combined sewers were recently separated in the northwestern area of the city near Alewife Brook and Massachusetts Ave. This action reduced the frequency of discharge from the four overflows to Alewife Brook. In Stoneham, combined sewer overflows severely degraded Sweetwater Brook, contributing to the pollution of the Aberjona River. A DWPC Step III grant made in 1983 provided separate streams for sewage and stormwater at all manholes.

REFERENCES

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Figure 21 MYSTIC RIVER BASIN and COASTAL DRAINAGE AREA (71)

TABLE 31
MYSTIC RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Aberjona River from its source in Reading to the Mystic Lakes. Upper and Lower Mystic Lakes. Mystic River to Amelia Earhart Dam, Somerville	18.4-2.0	B	NS	Ammonia. Dissolved oxygen. Coliform bacteria. Metals.	Leachate. CSO. Anoxic saline layer in Lower Mystic Lake.	Toxic element control and clean up. CSO separation in Stoneham. Correction of saline layer.
Mystic River from Amelia Earhart Dam to confluence with Chelsea River, Chelsea-Boston	2.0-0.0	SC	NS	Coliform bacteria. Oil & grease. Dissolved oxygen. Metals.	CSO.	CSO treatment.
Alewife Brook from Fresh Pond, Cambridge to confluence with Mystic River, Arlington-Somerville	2.0-0.0	B	NS	Coliform bacteria. CSO. Dissolved oxygen. Ammonia.		CSO separation and/or treatment.
Chelsea River from source to confluence with Mystic River, Boston	3.5-0.0	SC	NS	Coliform bacteria. CSO. Oil & grease. Metals. Dissolved oxygen.		CSO treatment proposed.

Miles Assessed: 23.9 mi
Miles Supporting Classification: 0 mi
Miles Partially Supporting Classification: 0 mi

NASHUA RIVER BASIN (81)

Description of the Watershed

The Nashua River, located in north central Massachusetts and southern New Hampshire, consists of a north branch and a south branch which combine in Lancaster, Massachusetts to form the main stem. The river then flows in a northeasterly direction until it joins the Merrimack River in Nashua, New Hampshire. The river's 530 square mile drainage area lies primarily within Worcester and Middlesex counties in Massachusetts and includes the 115 square mile watershed of the Metropolitan District Commission's Wachusett Reservoir. However, only 12 million gallons of water per week are released to the south branch from this reservoir. As a result the Wachusett watershed has only minor importance with respect to the flow in the rest of the river basin.

From the headwaters of the north branch in Fitchburg to its confluence with the south branch, a distance of 19 miles, the river elevation drops 360 feet. The main stem then falls another 110 feet along its remaining 37 mile course to the Merrimack River. The United States Geological Survey maintains a single flow-gaging station on the main stem at East Pepperell. The flow at this station over the past forty years averaged 560 cubic feet-per-second (cfs). Gaging stations are located on the north branch of the Nashua River in Leominster and Fitchburg. The average flow at the Leominster gage over the same forty-year period was 193 cfs. The new gage at Fitchburg showed average yearly flows of from 96 to 141 cfs from 1975 to 1980.

Water Quality Conditions and Trends

During the 1960's and early 1970's the Nashua River was probably the most polluted stream in Massachusetts. In the early 1970's over 30,000 pounds per day of BOD were discharged to the Nashua River. Major sources included four paper manufacturing companies in Fitchburg; inadequately treated municipal waste from seriously overloaded treatment plants in Fitchburg, Leominster, Clinton, and Ayer; combined sewer overflows in Fitchburg and Leominster; non-point sources; and treated paper manufacturing waste discharges in Pepperell and West Groton.

In 1975 two new wastewater treatment plants were completed in Fitchburg. The Fitchburg Westerly plant was designed to process paper manufacturing waste and small loadings of domestic wastewater, thereby eliminating the direct discnarge of untreated process waste to the north branch. The Fitchburg Easterly plant treated sanitary wastewater from the city. Both facilities were designed to provide better than secondary treatment. However, the westerly plant has exhibited many operational problems and it has not performed up to design expectations to date. The cities consultants are requesting a variance in water quality standards for two miles below the effluent discharge.

In 1977, BOD loadings to the Nashua River had been reduced to approximately 5,000-9,000 pounds per day. Water quality improvements have resulted from the construction of the Fitchburg treatment facilities. Since 1977, pollutant loadings have further been reduced by the completion of a new advanced wastewater treatment plant in Leominster in 1984, and a secondary treatment plant with phosphorus removal in Ayer in 1982. Sewer rehabilitation programs and the treatment plant upgradings have reduced BOD loadings an additional 3,000-8,000 pounds per day based on 1985 data.

Water quality problems still exist due to combined sewer overflows and dry weather sewage in the city of Fitchburg. The city is under an administrative order to develop a plan for the removal of the CSO's by July 1986.

The Clinton Wastewater Treatment Plant has an outdated collection system, inadequate capacity and severe inflow problems. During wet weather, bypass occurs to the south branch of the Nashua River. Consultants have prepared facility plans and designs for an upgraded facility with nitrification and phosphorus removal. The wastewater treatment plant presently contributes high concentrations of ammonia-nitrogen and phosphorus in the south branch.

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Figure 22 NASHUA RIVER BASIN (81)

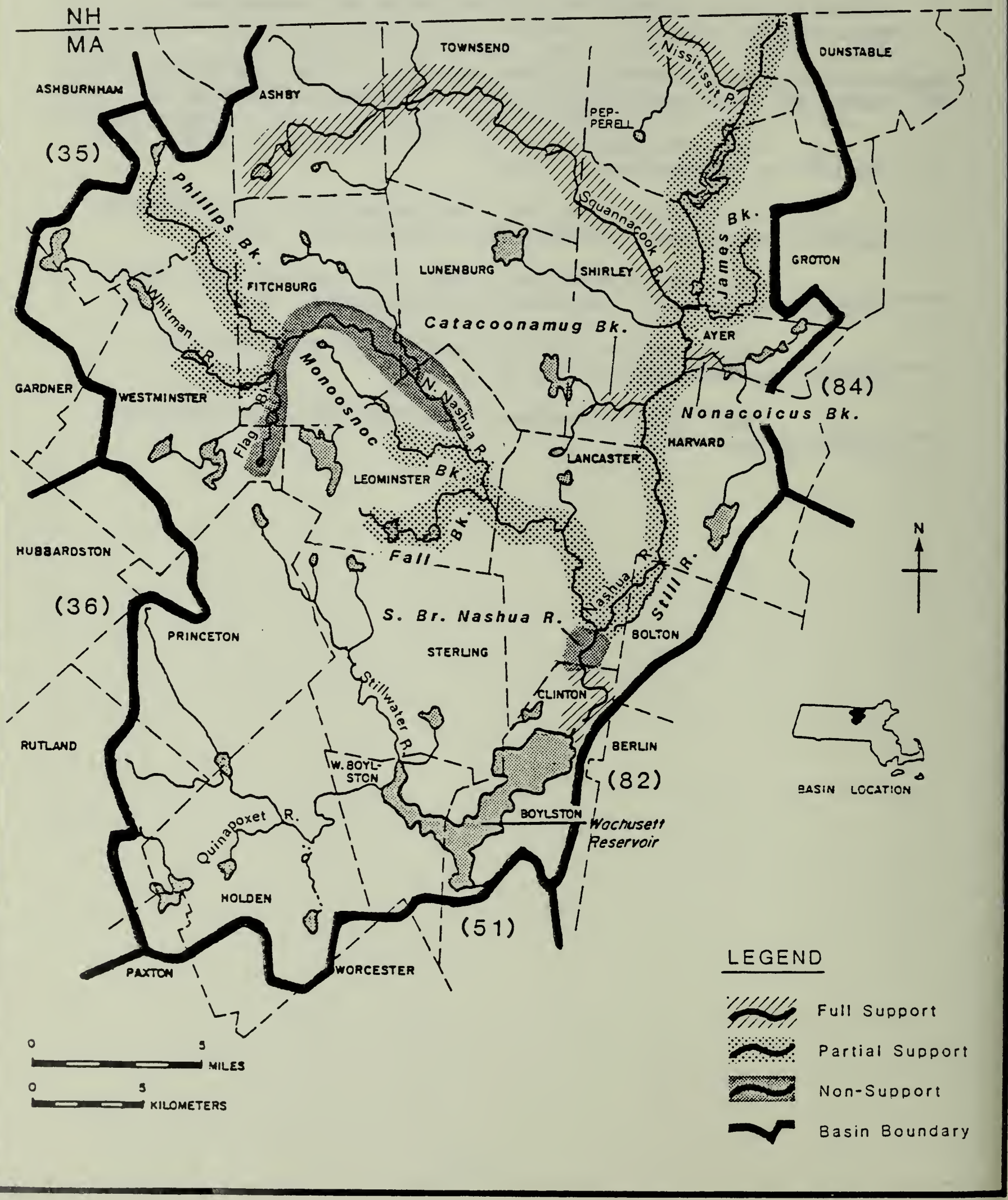

TABLE 32
NASHUA RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
North Nashua River						
Fitchburg Westerly WWTP to Fitchburg Easterly WWTP, Fitchburg	56.1-48.5	B	NS	Fecal coliform. BOD. Suspended solids.	Fitchburg West WWTP. Urban runoff. CSO's.	Correct operational problems at Fitchburg West WWTP.
Fitchburg Easterly WWTP to Leominster WWTP, Leominster	48.5-46.4	B	NS	Fecal coliform. Suspended solids.	CSO's. Urban runoff.	Eliminate CSO's.
Leominster WWTP to confluence with south branch, Lancaster	46.4-36.5	B	PS	Occassional coliform bacteria. Ammonia. Suspended solids.	CSO's. Urban runoff.	Sewer system rehabilitation. Eliminate CSO's.
Nashua River						
Confluence of north and south branches to Ice House Dam, Ayer	36.5-26.1	B	PS	Coliform bacteria. Occassional dissolved oxygen. Nutrients.	Upstream discharges.	Upgrade Clinton WWTP. Correct CSO's.
Ice House Dam to Pepperell Dam, Pepperell	26.1-14.2	B	PS	Occassional coliform. Occassional dissolved oxygen. Ammonia.	Runoff from Fort Devens.	Eliminate discharges.
Pepperell Dam to New Hampshire state line, Pepperell	14.2-10.5	B	PS	Occassional coliform.	Carry over from upstream.	Eliminate problems in upstream segment

TABLE 32 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
South branch Nashua River above Clinton WWTP, Clinton	4.6-1.6	B	S	--	--	--
Clinton WWTP to confluence with the Nashua River, Lancaster	1.6-0.0	B	NS	Dissolved oxygen. Ammonia. Phosphorus.	Clinton WWTP.	Upgrade Clinton WWTP.
Flag Brook from outlet of Crocker Pond to confluence with the Whitman River, Fitchburg	2.7-0.0	B	NS	Occassional dissolved oxygen. Suspended solids. Nutrients. Aesthetics.	Fitchburg landfill leachate.	Tie into Fitchburg West WWTP.
Whitman River	6.7-0.0	B	PS	Coliform bacteria.	Nonpoint sources. Untreated municipal discharges in South Ashburnham.	Facility planning for collection and treatment of sewerage in areas of critical water quality problems.
Phillips Brook	8.0-0.0	B	PS	Coliform bacteria.	CSO in Fitchburg. Nonpoint sources.	Facility planning for CSO management.
Monoosnuc Brook, downtown Leominster segment only	1.5-0.0	B	PS	Coliform bacteria.	Urban runoff. CSO in Leominster.	Sewer system rehabilitation in Leominster.

TABLE 32 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Fall Brook	3.0-0.0	B	PS	Occassional coliform bacteria.	Urban runoff. CSO in Leominster.	Fall Brook Interceptor completed.
Still River	3.1-0.0	B	PS	Coliform bacteria. Occassional dissolved oxygen.	Natural sluggish flow.	Survey work needed to determine abatement.
Catacoonamug Brook	2.0-0.0	B	S	--	--	--
Nonacoicus Brook	1.5-0.0	B	S	Occassional dissolved oxygen.	Natural conditions.	--
Squannacook River	14.3-0.0	B	S	--		
James Brook	4.4-0.0	B	PS	Coliform bacteria.	Nonpoint sources. Septic system failures.	Proper subsurface disposal
Nissitissit River	4.5-0.0	B	S	--	--	--

Miles Assessed: 101.9 mi
Miles Supporting Classification: 25.3 mi
Miles Partially Supporting Classification: 62.6 mi

NEPONSET RIVER BASIN (73)

Description of the Watershed

The Neponset River is bordered by the city of Boston on the north and Quincy on the south; it drains a watershed of 123 square miles. The river flows to Dorchester Bay after traveling approximately 30 miles.

The East Branch is the major tributary to the mainstem Neponset. Mother Brook, a man-made diversion, conveys one-third of the Charles River flow to augment low flows in the Neponset.

Most of the Neponset River is a fresh water stream. However, after being impounded in Milton by the Walter Baker Dam, the river becomes tidal.

Water Quality Conditions and Trends

Water quality problems in the Neponset River are typical of urban rivers. The estuarine portion of the Neponset River receives discharges from five NPDES permitted overflows from the Dorchester section of Boston. The river is impounded many times and so high nutrient loads create eutrophic conditions. The algal productivity, in turn, causes diurnal oxygen variations, which drop below the 5.0 mg/l standard in the pond off South Street in Walpole.

Excessive inflow and infiltration (I/I) in Canton, Norwood and Milton are responsible for wet weather discharge to the Neponset from overflows in Norwood and Milton. Canton has completed an I/I analysis and is currently performing a sewer system evaluation survey (SSES). An I/I analysis has been completed for Norwood and the interium report for the SSES has been completed. An administrative order was issued to the town in 1984 requiring I/I reduction. The town of Milton performed an analysis and found 3.12 mgd of peak I/I, of which none was found to be excessive but the town is being asked to reanalyze some of the data for areas that were not cost-effective.

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Figure 23 NEPONSET RIVER BASIN and COASTAL DRAINAGE AREA (73)

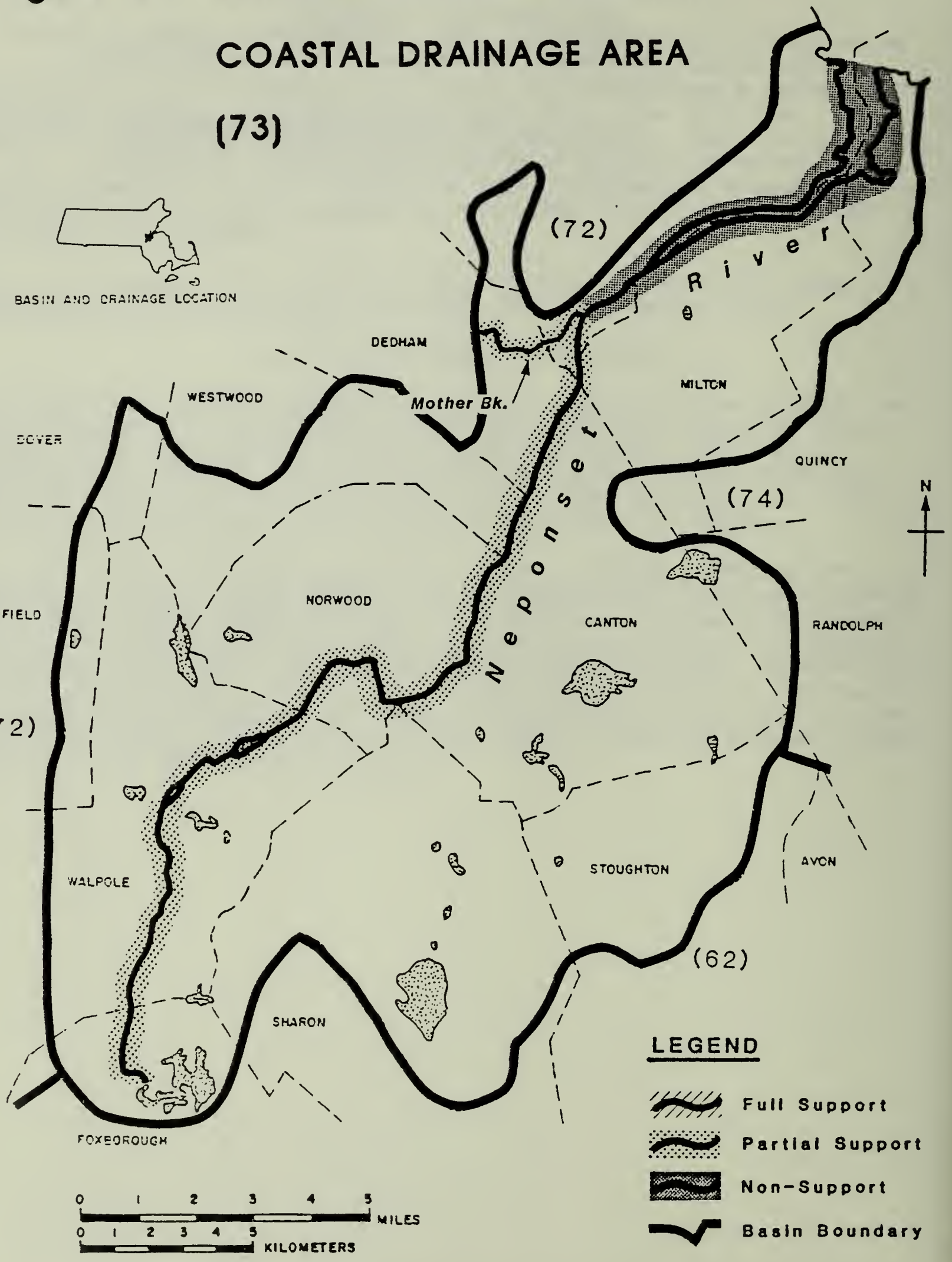

TABLE 33
NEPONSET RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Neponset River						
Neponset River from Neponset Reservoir, Foxborough to confluence with East Branch, Canton	29.5-15.8	B	PS	Periodic coliform. Diurnal dissolved oxygen variation.	Eutrophication. Urban runoff.	Detailed study of area is needed.
The East Branch to confluence with Mother Brook, Boston	15.8-7.9	B	PS	Coliform. Dissolved oxygen.	Urban runoff.	Detailed study of area is needed.
Mother Brook to Milton Lower Falls Dam, Milton-Boston	7.9-4.2	B	NS	Coliform.	Combined sewer overflows.	Combined sewer separation or treatment.
Milton Lower Falls Dam to Dorchester Bay, Boston-Quincy	4.2-0.0	SB	NS	Dissolved oxygen. Coliforms. Nutrients.	Combined sewer overflows.	Combined sewer separation or treatment.
Mother Brook						
Mother Brook Dam, Dedham to confluence with Neponset River, Boston	3.1-0.0	B	PS	Coliform. Nutrients.	Urban runoff.	Best management practices.

Miles Assessed: 32.6 mi
Miles Supporting classification: 0 mi
Miles Partially Supporting Classification: 24.7 mi

NORTH COASTAL DRAINAGE BASIN (93)

Description of the Watershed

The North Coastal drainage area extends from the Essex River to Boston Harbor. The sixteen cities and towns in the area range from highly urbanized Lynn, Salem and Beverly to rural Manchester and Essex. The total drainage area is 137.9 square miles, 43.0 miles of rivers have been assessed and 27.44 square miles of bays, and harbors have been assessed.

The major rivers are the Essex River in Essex, Annisquam River in Gloucester, Danvers River in Danvers and the Saugus and Pines Rivers in Saugus. Many smaller rivers and brooks from the inland rural areas feed into these larger rivers. Important harbors and bays are located in Essex, Rockport, Gloucester, Manchester, Beverly, Salem, Marblehead, Nahant and Lynn.

The harbors and bays support recreational, commercial, and industrial activities including fishing, boating, swimming and power generation. Freshwater resources are limited. Most of the inland rivers and brooks are too small for any kind of recreation. Groundwater resources are also relatively limited because of the nearness of crystalline igneous and metamorphic bedrock to the surface. The bedrock, which outcrops extensively along the shore, is a dominant physical aspect of this coastal area.

Water Quality Conditions and Trends

The north coastal area is well known for its fishing, lobstering and shellfishing industries. Starting in 1629 the Cape Ann and Salem Sound areas were catching and selling fish and setting up fishing stations and houses. Whaling also started in the mid 1600's, as Salem and Gloucester set up ports even before Nantucket. Shellfishing was also highly productive commercially.

During the 1700's the Salem-Beverly-Lynn area became industrialized, particularly the tanning industry. Tanneries and factories sprang up all along the rivers and tributaries leading to the bays and harbors, with raw sewage and untreated wastes discharged to the rivers. Consequently, the rivers and harbors became grossly polluted. In 1925, at the request of the Department of Public Health, the Division of Fisheries and Wildlife prohibited the taking of shellfish from areas in Danvers, Beverly, Salem, Manchester and Marblehead. Presently 60 percent of the shellfish flats north of Boston (including Ipswich, Parker and Merrimack Rivers) are closed to shellfish or are restricted and require depuration treatment. The remaining 40 percent of the shellfish flats are open. Depuration plants pass clean water over the midly contaminated shellfish, allowing then to naturally cleanse themselves.

An annual problem in the Cape Ann area is the occurrence of "Red Tide." "Red Tide" is the consequence of an algal bloom, one that is toxic to man. The alga is normally present in low concentrations, but occassionally rapid population increases (blooms) occur. The causes are unknown, but research on the natural or man-related causes continues.

Until recently, none of the 16 towns and cities within the basin treated their sewage. Beginning in the mid-1970's, wastewater treatment plants were constructed in the towns of Essex, Gloucester, Rockport, Manchester-Magnolia, Marblehead, Swampscott, Lynn and the South Essex Sewerage District (SESD) (serving Salem, Peabody Danvers and Beverly).

Under the 1977 amendments to the Clean Water Act, section 301(h) allowed existing marine dischargers an opportunity to investigate the environmental impact of primary effluent dischargers and to apply for a waiver of secondary treatment requirements. Each of these wastewater discharges conducted extensive water quality, biological and oceanographic sampling to be used in modeling programs that defined existing conditions and predicted future impacts. Calculations were made on the fate of pollutants, solids distribution and anticipated biological changes in receiving waters. All of these waivers, except Gloucester, have been rejected. Lynn and SESD are conducting more studies before they resubmit their 301(h) waivers.

Water quality monitoring has been conducted by the Division over the past decade. In 1976 a comprehensive survey was conducted on the entire north coastal inland and ocean waters. Since then, extensive surveys were conducted on Gloucester Harbor and the Saugus and Pines River in Lynn (1982) and Salem Sound (1983). The most recent survey, in the summer of 1985, included the rivers and tributaries leading into Salem and Beverly Harbors. Pollution sources and problems are being identified and actions will be taken to correct these problems.

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Figure 24 NORTH COASTAL DRAINAGE BASIN (93)

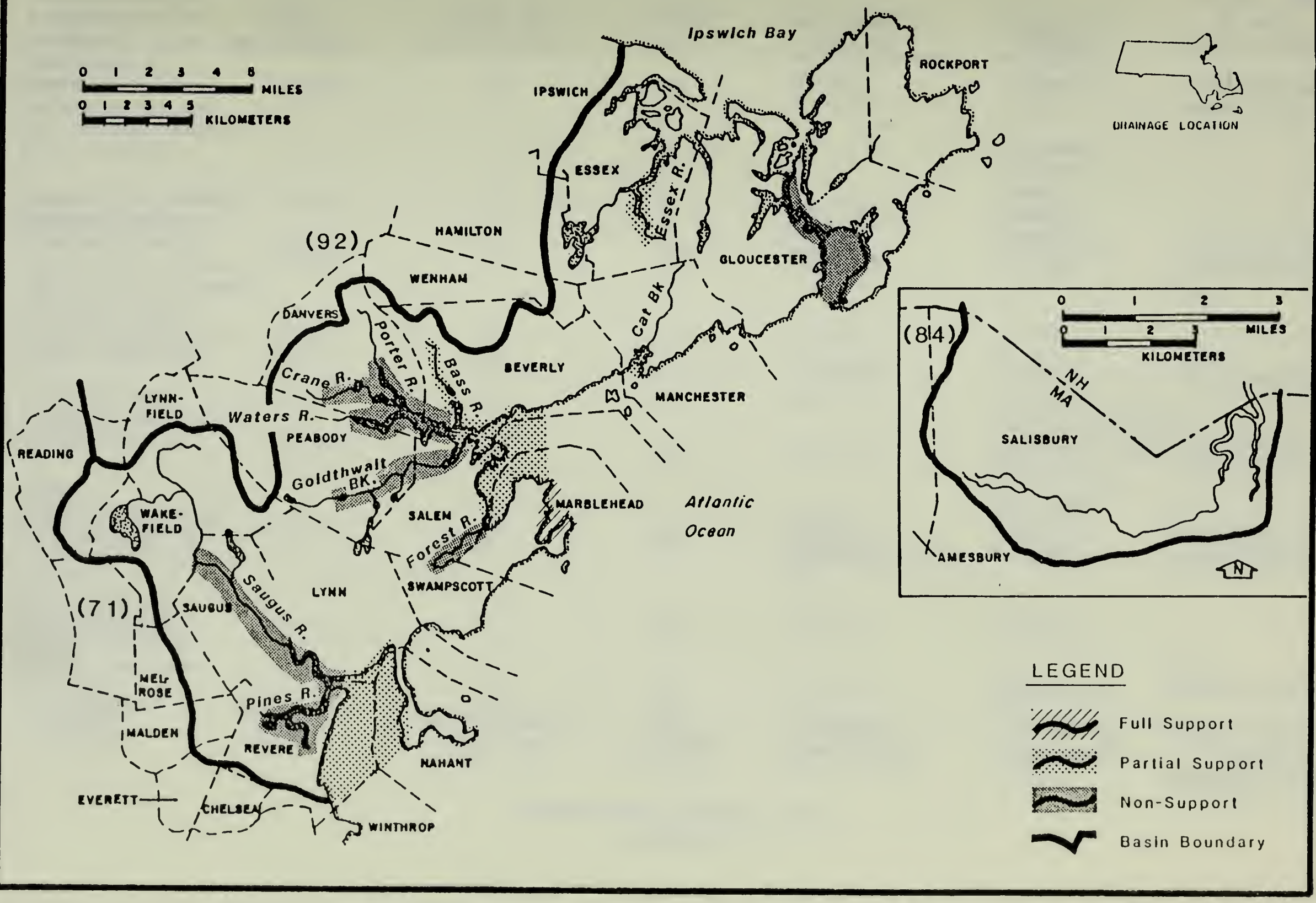

TABLE 34
NORTH COASTAL DRAINAGE BASIN

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Waters River from headwaters to confluence with Danvers River, Danvers	2.0-0.0	B	NS	Coliform.	Unknown.	Needs investigation.
Headwaters Crane Brook to Mill Pond, Danvers	3.9-1.6	B	NS	Coliform. Metals.	Unknown. Landfill upstream.	Needs further investigation.
Crane River from Mill Pond to Danvers River, Danvers	1.6-0.0	B	NS	Coliform.	Unknown.	Needs further investigation.
Parker River from Frost Fish Brook to confluence with Danvers River, Danvers	1.5-0.0	B	NS	Coliform.	Unknown.	Needs investigation.
Goldthwait Brook from Cedar Pond to North River, Peabody	3.3-0.0	B	NS	Coliform. Metals. Nutrients.	Landfill industrial complex. Former tanneries sediment.	Needs further investigation.
North River from confluence of Goldthwait Brook and Proctor Brook to confluence with Danvers River, Salem	2.7-0.0	B	NS	Coliform. Metals. Oil and grease.	Former tanneries. sediment. Unknown.	Needs further investigation.

TABLE 34 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Bass River, from headwaters to confluence with Danvers River, Beverly	3.7-0.0	B	PS	--	--	--
Danvers River from source to mouth	1.9-0.0	SB	S	--	--	--
Forest River, Salem	0.5-0.0	B	NS	Coliform.	Unknown.	Needs investigation.
Essex River from source to mouth	4.9-0.0	SA	PS	Coliform.	Unknown.	--
Annisquam River from source to mouth	3.6-0.0	SA	NS	Coliform.	Domestic sewage. Vessel discharges. Combined sewage overflows. Urban runoff.	
Saugus River from source to mouth	8.6-0.0	SB	NS	Coliform. Dissolved oxygen. Metals.	Unknown.	Needs further investigation.
Pines River from source to mouth	6.4-0.0	SB	NS	Coliform.	Unknown.	
Essex Bay	1.15 mi^2	SA	U	--	Essex River tributary to bay has known coliform problems.	--

TABLE 34 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Rockport Harbor	0.019 mi^2	SB	U	--	Rockport secondary wastewater treatment plant discharges to bay	--
Gloucester Harbor	2.24 mi^2	SB	NS	Coliform. Oil and grease.	Untreated discharge. CSO's.	New WWTP recently completed construction, study on diffuser location underway.
Manchester Harbor	0.29 mi^2	SB	PS	Coliform.	Vessel discharges. Polluted tributary water.	Stop tributary contamination.
Beverly Harbor	0.78 mi^2	SB	PS	Coliform.	SESD.	Upgrade SESD extend outfall.
Salem Harbor	1.62 mi^2	SB	PS	Coliform.	SESD.	Upgrade SESD extend outfall.
Marblehead Harbor	0.56 mi^2	SA	S	--	Possible problem from vessel discharge.	--

TABLE 34 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Lynn Harbor	6.67 mi^2	SB	PS	Coliform.	CSO's. Lynn raw discharge. Urban runoff.	Upgrade Lynn treatment plant and extend diffuser outfall.
Nahant Bay	5.27 mi^2	SA	PS	Coliform.	CSO's. Lynn raw discharge.	Upgrade Lynn treatment plant and extend diffuser outfall.
Salem Sound	10.01 mi^2	SB	PS	Coliform. Nutrients. Heavy metals.	SESD not operating well.	Upgrade SESD to secondary treatment and extend ocean diffuser.

Miles Assessed: 43.0 mi
Miles Supporting Classification: 1.9 mi
Miles Partially Supporting Classification: 8.6 mi

Square Miles Assessed: 27.44 mi^2
Square Miles Supporting Classification: 0.56 mi^2
Square Miles Partially Supporting Classification: 24.64 mi^2

PARKER RIVER BASIN (91)

Description of the Watershed

The Parker River Basin lies between the drainage basins of the Ipswich and Merrimack Rivers in northeastern Massachusetts. All or part of nine communities lie within the 60 square mile area drained by the Parker River. The basin is generally rural - residential in nature, with only minor industrial development. The estuarine portion of the Parker River is a magnificent natural resource and is protected under the Wild and Scenic Rivers Act.

The Parker River rises at the confluence of two unnamed brooks in a wetland area in West Boxford. The river flows generally in a northeasterly direction through several small ponds and extensive wetland areas in the towns of Boxford, Groveland, and Newbury. In Newbury, and for the nine miles to the coast, the river is tidal. The Parker River flows through extensive coastal wetlands to its mouth where it empties into Plum Island Sound.

The Parker River is 23 miles long, drains 60 square miles, and has an average discharge into Plum Island Sound of 97.2 cfs. From its source to its mouth the Parker River falls a total of 95 feet, of which 36 feet are taken up by the six dams on the river.

The major topographic features of the Parker River Basin are low, rounded hills, freshwater wetlands, saltwater marshes and several lakes and ponds which have formed in depressions in wetland areas.

Water Quality Conditions and Trends

The freshwater portion of the Parker River flows through extensive wetland areas and is impounded in two locations by man-made dams. The wetland conditions, accompanied with low stream flow, produce naturally occurring low dissolved oxygen levels. In addition, as the river flows through several rural towns, it is subject to runoff and septic tank leachate. Neither of these water quality impacts are considered serious; hence, the river meets its assigned classification.

Analysis of the estuarine portion of the river has shown moderate dissolved oxygen and bacterial standards violations. It is projected that the causes are natural, probably the saltwater marsh influence and thus, this portion is listed as meeting its classification.

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Figure 25 PARKER RIVER BASIN (91)

LEGEND

- Full Support
- Partial Support
- Non-Support
- Basin Boundary

TABLE 35
PARKER RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Parker River						
Its source in Boxford to Central Street, Newbury	22.0-9.0	B	S	Dissolved oxygen.	Natural conditions.	--
Central Street, Newbury to its mouth at Plum Island Sound, Newbury	9.0-0.0	SA	S	Dissolved oxygen. Total coliform bacteria.	Natural conditions.	--

Miles Assessed: 22.0 mi
Miles Supporting Classification: 22.0 mi
Miles Partially Supporting Classification: 0 mi

QUINEBAUG RIVER BASIN (41)

Description of the Watershed

The Quinebaug River Basin covers 744 square miles in south central Massachusetts, eastern Connecticut, and northwestern Rhode Island. The Quinebaug River flows 76 miles from its source in Mashpaug Pond in Union, Connecticut to its confluence with the Shetucket River in Norwich, Connecticut. Of the Quinebaug's 76 miles, 28 lie in Massachusetts and drain an area of 148 square miles. Major tributaries are Cady Brook in Massachusetts and the French, Five Mile, Moosup, and Pachaug Rivers in Connecticut. Of these, the French is the largest, extending 26 miles from its source in Greenville Pond, Leicester, Massachusetts to the confluence with the Quinebaug River in Thompson, Connecticut.

From its source in Mashpaug Pond, the Quinebaug River flows a short distance northwest to Hamilton Reservoir, which lies on the Connecticut-Massachusetts state line. Leaving this reservoir in Holland, Massachusetts, the river flows north to Sturbridge, where it passes through Old Sturbridge Village. Upon leaving Sturbridge, the river turns southeast to Southbridge where it is joined by Cady Brook, Dresser Hill Brook, and Lebanon Brook, and on through Dudley to recross the state line. After the French River enters in Thompson, Connecticut, the Quinebaug flows generally south through Putnam, Danielson, and Plainfield to its confluence with the Shetucket River in Norwich. This confluence forms the Thames River, which continues south to Long Island Sound.

The Sturbridge and Southbridge Sewage Treatment Plants along with the American Optical Corporation discharge their effluents to the Quinebaug River in Massachusetts. Additional wastes are discharged to Cady Brook in Charlton, Massachusetts by the town's sewage treatment plant, one industry and several small domestic waste overflows.

Three major flood control dams were constructed on the Quinebaug River by the U.S. Army Corps of Engineers following extensive flooding in 1955. These are the East Brimfield and Westville Dams in Massachusetts and the West Thompson Dam in Connecticut. The U.S. Geological Survey maintains three flow gaging stations on the Quinebaug River, two of which are located just downstream from the East Brimfield and Westville Dams. The East Brimfield gage drains an area of 67.5 square miles and has an average discharge of 140 cubic feet per second for a recording period of 1972 to 1979, while the Westville gage has an average flow of 168 cubic feet per second for the period of record from 1963 to 1979 and has a drainage area of 99.1 square miles. The third U.S.G.S. gage is located in Quinebaug, Connecticut. It drains an area of 156 square miles and has an average discharge of 270 cubic feet per second from 1931 to 1979.

Water Quality Conditions and Trends

In the early 1800's factories and mills sprang up in areas adjacent to the Quinebaug River in Sturbridge, Southbridge, and Dudley and on Cady Brook in Charlton. These factories subjected the river to high oxygen demand and nutrient loadings. Today these towns remain industrialized, but with treated effluents discharging to the river.

Construction of wastewater facilities in the towns of Sturbridge, Southbridge and Charlton helped eliminate the direct discharges of untreated sewage and industrial wastes to the river. Since initial construction the Sturbridge plant has been expanded, the Southbridge plant is under construction for advanced treatment, and facility plans for upgrading the Charlton City plant are underway. Water quality has also improved as a consequence of American Optical treating their wastes prior to discharge and two major companies going out of business. The quality of the river is improving, and class B water quality standards are being met.

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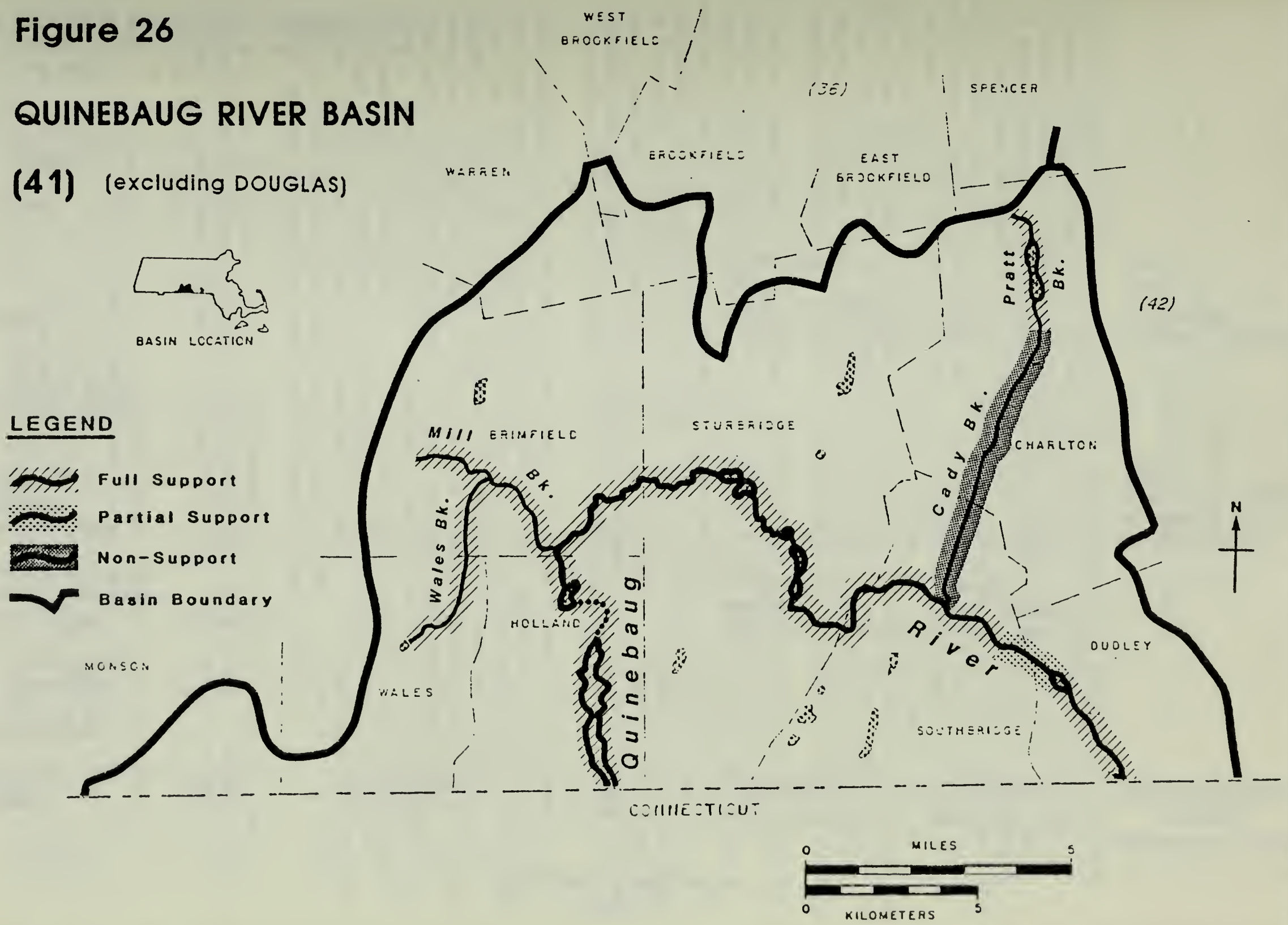
Figure 26

QUINEBAUG RIVER BASIN

(41) (excluding DOUGLAS)



LEGEND

- Full Support
- Partial Support
- Non-Support
- Basin Boundary

TABLE 36
QUINEBAUG RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Quinebaug River						
Above Sturbridge WWTP, Sturbridge	30.7-19.1	B	S	--	--	--
Quinebaug River from Sturbridge WWTP to Southbridge WWTP	19.1-12.2	B	S	Coliform bacteria. Solids. Phosphorus.	Sturbridge WWTP in wet weather.	--
Southbridge WWTP to West Dudley Impoundment, Dudley	12.2-10.2	B	PS	Coliform bacteria.	Southbridge WWTP.	Expansion and upgrading to be completed Fall 1987.
West Dudley Impoundment to Mass-Conn. state line	10.2-7.9	B	S	--	--	--
Cady Brook	6.1-0.0	B	NS	Coliform bacteria. Dissolved oxygen. Solids. Phosphorus.	Charlton City WWTP.	Upgrade Charlton City WWTP. Evaluate sewer needs.
Mill Brook	4.3-0.0	B	S	--	--	--
Wales Brook	4.9-0.0	B	S	--	--	--

Miles Assessed: 38.1 mi
Miles Supporting Classification: 30.0 mi
Miles Partially Supporting Classification: 2 mi

SHAWSHEEN RIVER BASIN (83)

Description of the Watershed

The Shawsheen River originates near L.G. Hanscom Field in Bedford, at the confluence of Kiln Brook and an unnamed brook, and flows generally northeast through Billerica, Tewksbury, and Andover where it enters the Merrimack River in South Lawrence. The terrain of the watershed is made up of low, rounded hills and many wetland areas. The river and its flood plain are surrounded by residential communities. At its headwaters, the Shawsheen River drains portions of Lincoln, Lexington, and Bedford. From its origin, the river journeys north-northeasterly through Bedford where it is joined by Elm Brook just north of the center of Bedford. It continues through Bedford where it is fed by Spring Brook and Vine Brook. Vine Brook, the largest tributary stream of the Shawsheen River, drains an area of approximately ten square miles. This area is highly industrialized and populated, encompassing the Burlington Mall shopping center complex in Burlington and industries along the Route 128-Route 3 highway system.

Crossing under Route 62 in Bedford, the Shawsheen enters a slow-moving sluggish stretch. The flood plain of the river widens here, forming a marsh area. Entering Billerica, the river meanders considerably and continues to be slow-moving. The terrain along the watershed becomes more wooded and marshy. Continuing its northeasterly direction through Billerica, the Shawsheen River is joined by McKee Brook, Beaver Brook, Webb Brook, Jones Brook, and a few other small, unnamed tributaries before entering Tewksbury. It continues its course through Tewksbury where it is joined by Strong Water Brook. Other small unnamed tributaries drain mostly swampy regions of the watershed.

Past Tewskbury the river enters the Town of Andover, where it is impounded by its first dam in the Village of Ballardvale. The backwater creates a considerable time of travel through this stretch during low flow conditions. The outlet stream from Fosters Pond also enters the impoundment near Ballardvale. Just downstream of the dam, the village operates a small extended aeration wastewater treatment plant which discharges its effluent into the Shawsheen River. From here to "Horn Bridge", the river meanders through the Vale Reservation and the Shawsheen River Reservation. This stretch offers excellent recreational opportunities such as canoeing and nature study. From "Horn Bridge", the river passes through the Indian Ridge Reservation before it is impeded by its second and last impoundment, just outside of Andover center. In Andover, the river flows through residential areas before entering South Lawrence.

In South Lawrence, the banks of the Shawsheen are bordered by Denroek Park, Memorial Park, Shawsheen Park, Costello Park, and Coyne Park. The river then passes under Merrimack Street and disappears under some industries before it enters the Merrimack River.

The only United States Geological Survey gaging station on the Shawsheen is located at the Billerica-Wilmington town line on Route 129, near the old Middlesex Canal. The drainage area at this point is 35.1 square miles. The average discharge since the gage was constructed in 1964 has been 50.9 cubic feet per second (cfs). The maximum discharge recorded was 1,050 cfs on March 19, 1968, and the minimum discharge recorded was 1.2 cfs on August 30, 1966.

Water Quality Conditions and Trends

The Shawsheen River Basin, like much of eastern Massachusetts during the mid 1980's, is experiencing considerable development pressure. The river generally meets class B standards for water quality. Elevated nutrient levels from non-point sources contribute to increased phytoplankton counts and subsequent diurnal dissolved oxygen fluctuations. Furthermore, much of this stream flows sluggishly through wetlands and freshwater marshes which are highly productive. Natural dissolved oxygen depletion and increased nutrient content are associated with these wetland areas. Coliform bacteria counts are high in Andover and South Lawrence due to small wastewater discharges and urban runoff. The Shawsheen River and its major tributaries were last sampled in 1982.

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Figure 27 SHAWSHEEN RIVER BASIN (83)

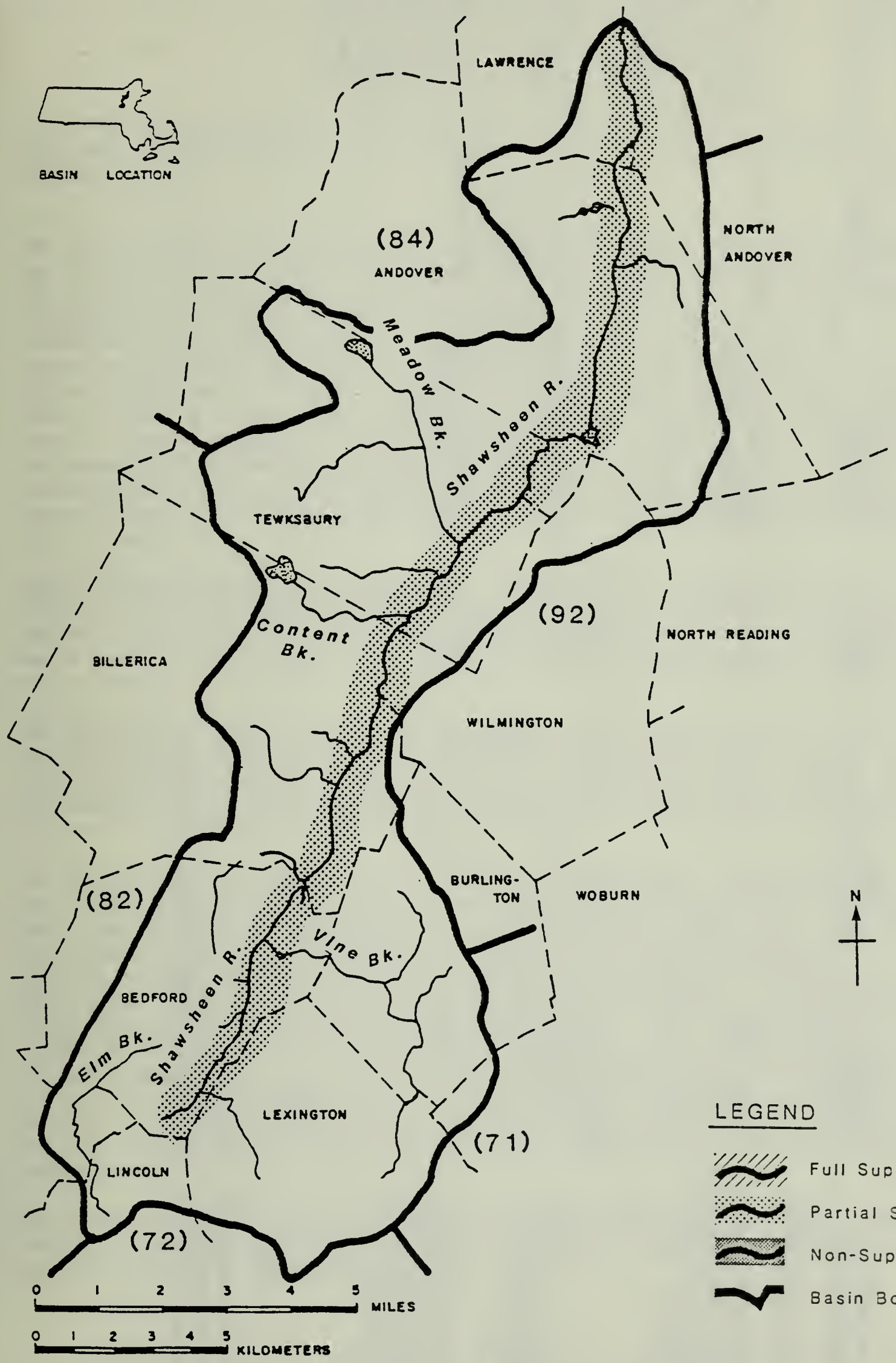

TABLE 37
SHAWSHEEN RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Shawsheen River						
Shawsheen River from Maguire Road to Spring Brook, Bedford	25.0-23.3	B	PS	Dissolved oxygen. Coliform bacteria.	Urban runoff.	Initiate storm-water management practices in the town of Bedford as recommended in the MAPC 208 report.
Spring Brook to Horn Bridge, Andover	23.3-5.9	B	PS	Coliform bacteria. Dissolved oxygen.	Urban runoff. Natural conditions.	Best management practices (BMP).
Horn Bridge to confluence with Merrimack River, Lawrence	5.9-0.0	B	PS	Coliform bacteria. Dissolved oxygen.	Urban runoff.	Initiate storm-water management techniques in Andover and Lawrence as outlined in MVPC 208 report.

Miles Assessed: 25.0 mi
Miles Supporting Classification: 0 mi
Miles Partially Supporting Classification: 25.0 mi

SOUTH SHORE DRAINAGE BASIN (94)

Description of the Watershed

The South Shore drainage area is located southeast of the Metropolitan Boston area and includes two major river basins, the North River and Jones River Basins.

The Nortn River is essentially two rivers. The portion above Curtis Crossing Dam in Hanover is a freshwater stream which originates near the Weymouth Naval Air Station at the French Stream. The French Stream flows through Abington, Rockland and into Hanover where upon the Drinkwater River flows into the mainstem and the river becomes the Drinkwater River. When Indian Head Brook flows into the mainstem river in Hanson, the river again changes its name to the Indian Head River. The Indian Head River is impounded by the Curtis Crossing Dam in Hanover. Below Curtis Crossing, the North River becomes saline and subject to tidal influence. The river flows through Pembroke, Norwell, Scituate and Marshfield discharging to Massachusetts Bay. Approximately nine river miles are freshwater and 11.5 river miles are subject to tidal effects. The river flows through and receives drainage from natural wetlands and marshes along much of its length.

Major tributaries are the South River, which enters in Marshfield, Third Herring Brook which enters at the Norwell-Hanover town line, First Herring Brook which enters in Scituate, and the Upper Drinkwater River which enters in Hanover. Major ponds in the basin include Adham Pond, Indian Head Pond and Great Sandy Bottom Pond.

The North River Basin drains a total area of 105.4 square miles. The United States Geological Survey (U.S.G.S) operates a gaging station at Curtis Crossing which drains 50.3 square miles. Over the last 17 years, the gage has recorded an average flow of 62.4 cubic feet per second (cfs) with maximum and minimum flows of 1,390 cfs and 0.14 cfs, respectively.

The Jones River originates at the outlet of Silver Lake in Kingston and flows in an east-southeasterly direction for approximately seven miles to Plymouth Bay. The Jones River Basin drains a total area of 22 square miles excluding 4.1 square miles above the outlet of Silver Lake. Major tributaries to the Jones River are Pine Brook and Halls Brook which originate in Duxbury; Jones River Brook which drains sections of Plympton and Kingston; and Fountainhead Brook and Smelt Brook which originate in Kingston. Two major impoundments are joined at Route 106 and Elm Street, the latter of which is considered the end of the freshwater portion of the river. The USGS maintains a flow-gaging station located just downstream of the Elm Street Impoundment which drains an area of 15.9 square miles. Over the last 17 years, the gage has recorded an average flow of 31.5 cfs with maximum and minimum flows of 575 cfs and 6.59 cfs, respectively.

The remainder of the South Shore Basin include several small streams including the Eel, Bluefish, and Duck Hill Rivers and Beaver Dam, Indian and Town Brooks which discharge to Cape Cod Bay.

All of the surface waterbodies except the North River are maintained largely through the discharge of groundwater from underlying aquifers. This is particularly true during the summer dry months. The delicate balance between demands for subsurface drinking water supplies and surface water quantity and quality is a primary planning concern in the South Coastal drainage area.

Water Quality Conditions and Trends

For many years, domestic and industrial wastewater in Weymouth, Abington, Rockland, and Scituate had subjected the North River, in particular the freshwater portion upstream of Curtis Crossing, to high loadings of oxygen-demanding and nutrient-laden pollutants. Discharges from the Naval Air Station in Weymouth, Plymouth Rogers Division - Colonial Provision Company in Abington and Clark-Bubbitt Foods in Rockland, which severely polluted the North River, had been eliminated by 1977. However, dissolved oxygen levels remained low and nutrient loads remained high due to the North Abington and Rockland Wastewater Treatment Plants. For this reason the Rockland Wastewater Treatment Plant was expanded and upgraded to an advanced treatment facility that began operation in the summer of 1982. Wastewater discharges from North Abington were sewered to the Rockland plant. By February 1984 all discharges from the North Abington Wastewater Treatment Plant had been eliminated.

These improvements have increased dissolved oxygen levels and substantially decreased nutrient loadings to the freshwater portion of the North River. However natural conditions in the adjoining wetlands, urban runoff in Rockland, and failing septic systems in Hanover prevent the North River from continually meeting its classification. Isolated wastewater discharges in North Abington and Rockland and runoff from Rockland, North Abington and the Weymouth Naval Air Station cause high coliform levels and slighly elevated nutrient concentrations.

Increased nitrate-nitrogen concentrations, which are directly available to algae and aquatic plants, result from the process of ammonia removal at the Rockland Wastewater Treatment Plant. These concentrations persist two miles downstream of the effluent channel. Phosphorus concentrations, although greatly reduced, are still significant with respect to eutrophication in the impoundments. Some of this phosphorus appears to be natural background concentration.

Downstream of Curtis Crossing Dam where the North River is subject to tidal influences, coliform concentrations have increased, preventing the entire segment from meeting its class SB and SA standards. The remainder of the North River is subjected to several potential sources of coliform that prevent the river from meeting its SA classification or even class SB standards. These sources include low lying houses, failing septic systems, marinas, watercraft and the Scituate Wastewater Treatment Plant. Potential pollution sources were located by the DEQE Shellfish Section during shoreline surveys conducted in September 1984.

The Scituate Wastewater Treatment Plant has experienced problems with overloading of its sand filter beds which are used to dispose of the effluent. A facility plan was completed in December 1984 that recommended the design and construction of a mechanical filtration system with chlorination-dechlorination facilities. If the proposed discharge is capable of meeting class SA standards, the completed facility would help reduce coliform densities in First Herring Brook.

The South River, like the North River, yields high coliform counts. Potential sources include runoff from Duxbury and Marshfield, failing septic systems, marsh and wetland, and watercraft. In order to develop a management plan for the North and South Rivers, the North River Commission has selected a consultant to develop a sampling and analysis program to determine the sources of the coliform contamination.

The remaining surface waters of the South Shore drainage are standard in terms of water quality. The town of Kingston is currently designing a wastewater collection and treatment system to eliminate septic tank failures. Cohasset will be completing a facility plan for upgrading its treatment plant and collection system. The Plymouth Wastewater Treatment Plant has high inflow/infiltration problems, which have been evaluated.

The South Coastal drainage area as a whole is subjected to seasonal water quality degradation as a result of increased population during the summer months. The number of failing septic systems increases seasonally due to increased use, improper maintenance, and fluctuations in groundwater levels. Another problem plaguing the coastal communities is the discharge of wastes from marine vessels moored in the harbors. As noted, these problems are accentuated in the summer months with a large influx of seasonal residents, vacationers, and tourists. However, a long term effect on the quality of surface waters and groundwater will most occur as the demand for drinking water increases and the population continues to grow. The delicate balance between groundwater withdrawal and groundwater discharge to surface water bodies must be maintained to insure the high quality of both.

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Figure 28

SOUTH SHORE COASTAL DRAINAGE AREA (94)

COHASSET
SCITUATE
(74)
HINGHAM
WEYMOUTH
NORWELL
North River
South River
French Stream
Drinkwater R.
MARSHFIELD
ABINGTON
HANOVER
ROCKLAND
Indian Head R.
Green Harbor R.
WHITMAN
HANSON
PEMBROKE
DUXBURY
(62)
HALIFAX
Jones River
KINGS-TON
Plymouth Bay
PLYMPTON
Cape Cod Bay
CARVER
PLYMOUTH
(95)
BOURNE
(96)
Cape Cod Canal
N
LEGEND
Full Support
Partial Support
Non-Support
Basin Boundary
0 1 2 3 4 5 MILES
0 1 2 3 4 5 KILOMETERS

TABLE 38
SOUTH SHORE DRAINAGE BASIN

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Cohasset Harbor, Cohasset	0.83 mi^2	SA	PS	Coliform bacteria.	Cohasset WWTP.	Upgrade Cohasset WWTP to provide secondary treatment.
Scituate Harbor, Scituate	0.31 mi^2	SA	PS	Occassional coliform bacteria.	Unknown.	Eliminate/treat sources.
North River						
Weymouth Naval Air Station to inlet Studleys Pond, Rockland	23.2-18.9	B	PS	Coliform bacteria.	Untreated wastewater discharges runoff.	Eliminate/treat sources.
Studleys Pond to Rockland WWTP, Rockland	18.9-17.0	B	PS	Occassional coliform bacteria. Dissolved oxygen. Phosphorus.	Runoff wetlands.	--
Rockland WWTP to outlet Factory Pond, Hanover	17.0-14.0	B	PS	Dissolved oxygen. Phosphorus.	Wetlands runoff. Natural conditions.	--
Outlet Factory Pond to Curtis Crossing Dam, Hanover-Pembroke	14.0-11.6	B	PS	Occassional coliform bacteria. Dissolved oxygen. Nutrients.	Wetlands untreated domestic wastewater discharges.	Septic tank rehabilitation/ maintenance.

TABLE 38 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Curtis Crossing Dam to Third Herring Brook, Hanover	11.6-9.6	SB	PS	Coliform bacteria. Dissolved oxygen.	Wetlands runoff.	Study underway to address sources of coliform bacteria in North and South Rivers and recommend plan to eliminate/ treat these sources.
North River from Third Herring Brook to Massachusetts Bay	9.6-0.0	SA	PS	Coliform bacteria. Dissolved oxygen.	Septic system. Boating discharges. Scituate WWTP.	Problem is being studied. Facility planning report completed.
South River	10.6-0.0	SA	PS	Coliform bacteria. Dissolved oxygen.	Wetlands. Septic systems. Boating discharges.	Problem is being studied.
Green Harbor River, Marshfield	2.5-0.0	B	PS	Dissolved oxygen. Nutrients. Coliform bacteria.	Wetlands. Failing septic systems.	Septic system rehabilitation/ maintenance.
Jones River to Elm Street, Kingston	7.0-2.5	B	PS	Occassional dissolved oxygen.	Wetlands. Failing septic systems.	Septic system rehabilitation/ maintenance.
Jones River estuary, Kingston	2.5-0.0	SA	PS	Coliform bacteria.	Untreated domestic wastewater discharges.	Eliminate/treat sources.
Duxbury Bay, Kingston	13.46 mi^2	SA	S	--	--	--

TABLE 38 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES/AREA	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Plymouth Harbor, Plymouth	2.61 mi^2	SA	PS	Coliform bacteria.	Plymouth WWTP. Combined sewer overflows. Boating discharges.	Treatment/ eliminate of known sewage outfalls to harbor.
Plymouth Bay, Plymouth	--	SA	S	--	--	--

Miles Assessed: 43.3 mi
Miles Supporting Classification: 0.0 mi
Miles Partially Supporting Classification: 43.3 mi

Square Miles Assessed: 17.21 mi^2
Square Miles Supporting Classification: 13.46 mi^2
Square Miles Partially Supporting Classification: 3.75 mi^2

STONY BROOK BASIN (34)

Description of the Watershed

Stony Brook originates between Ayer and Littleton as Beaver Brook and flows generally northeast through Littleton, Westford and North Chelmsford where it enters the Merrimack River. In its 22 mile length, it drains an area of approximately 51 square miles and falls 200 feet. Dams create many impoundments along its entire length. The mainstem is fed by numerous small brooks and streams along its path to the Merrimack River. The basin also includes a number of lakes and ponds very suitable for recreational activities. Among these, Long Sought-for Pond in Westford provides excellent trout fishing.

These are numerous wastewater discharges within the Stony Brook Basin. These range from food processing wastes to industrial cooling water.

Water Quality Conditions and Trends

Water quality conditions in this small sub-basin of the Merrimack River is dominated by three (3) factors: the large number of impoundments or ponds (6) along its 22 mile length, generally flat gradient and adjacent wetlands, and industrial discharges.

The combination of these factors contribute to dissolved oxygen fluctuations, nutrient loadings, excessive algal and macrophytic growth and localized high coliform levels. While there has not been any intensive basin-wide surveys since 1974 there have been more recent examinations during 1984 of one of the tributaries (Mill Brook) and two of the principal industrial sources, New England Apple Products, and Westford Anodizing.

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Figure 29

STONY BROOK BASIN (84b)

TABLE 39
STONY BROOK BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Beaver Brook						
Wolf Swamp, Mill Brook, Mill Pond at Route 110-2A, Littleton	22.0-15.6	B	NS	Dissolved oxygen. Coliform. Nutrients.	Wetlands. Impoundments. Industrial sources.	Upgrade study effects to better quantify problem.
Route 110-2A Forge Pond to Stony Brook at Concord Road, Route 225, Westford	15.6-10.3	B	PS	Dissolved oxygen. Coliform. Nutrients.	Wetlands. Impoundments. Industrial sources. Urban runoff.	Review NPDES wasteload allocations. Upgrade storm water management practices.
Stony Brook						
Concord Road Route 225, to School St., Chelmsford	10.3-2.5	B	PS	Dissolved oxygen.	Wetlands. Natural sources. Industrial sources.	Upgrade water quality data base. Review NPDES wasteload allocations.
School St., West Chelmsford to mouth, Merrimack River	2.5-0.0	B	PS	Coliform. Nutrients.	Urban runoff. Industrial sources.	Upgrade storm water management practices. Wasteload allocation study.

Miles Assessed: 22.0 mi
Miles Supporting Classification: 0 mi
Miles Partially Supporting Classification: 15.6 mi

SUDBURY AND CONCORD RIVER BASINS (32)

Description of the Watershed

The Sudbury River has its beginning in the town of Westborough, flowing from Cedar Swamp Pond eastward to Framingham, then north through the towns of Sudbury, Wayland, Lincoln, and into the town of Concord. The Sudbury River is characterized by three distinct physical sections. Upstream of Framingham the river is narrow, rapidly-flowing and dotted with a few small impoundments. In Framingham, the river has two large impoundments: the first is part of the Metropolitan District Commission (MDC) water supply, and the second is created by the Colonna Dam in Saxonville. The third and unique section of the river is that which flows through the Great Meadows National Wildlife Refuge meadowlands in the towns of Sudbury, Wayland, Lincoln, and Concord. Through this area (river distance of 12 miles), the river's elevation changes only one foot and the river is akin to an elongated lake.

The Sudbury River is 41 miles long with a drainage area of 160 square miles, 29 of which drain to the MDC reservoirs. In Concord the Sudbury River joins the Assabet River to form the Concord River.

The Concord River flows north through the towns of Concord, Carlisle, Bedford, Billerica, and the city of Lowell where it discharges into the Merrimack River. The Concord River retains the slow-moving characteristic of the Sudbury River as it flows north through the Great Meadows Wildlife Refuge Area. From the Talbot Dam in Billerica, it is an urban river, receiving industrial and municipal discharges in the Lowell area.

The Concord River is 15.8 miles long and drains 62 square miles for a combined total (including the Assabet and Sudbury Rivers) of 406 square miles. The Concord River Basin has two main urban centers in Lowell and Concord and some rural areas such as in Carlisle.

The United States Geological Survey (USGS) maintains one flow gaging station on the Sudbury River in Saxonville. One USGS flow gaging station is maintained on the Concord River in Lowell.

Water Quality Conditions and Trends

Unlike the Assabet River, which has to contend with a number of WWTP discharges in close proximity, the Sudbury and Concord Rivers are relatively free of such impacts. However, natural conditions in the Sudbury and Concord basins, compounded by urban runoff, prevent the Sudbury and Concord Rivers from maintaining a class B condition along their full lengths. Nevertheless, the 1979 survey data indicate that the upper portions of both the Sudbury River and the Concord River do meet class B water quality conditions. With the elimination of the combined sewer overflows in 1980 by routing the combined wastewater to the Duck Island Wastewater Treatment Plant in Lowell, much of the Concord River is partially meeting its class B standards.

The Metropolitan District Commission maintains a number of reservoirs in the Sudbury basin. Currently it is investigating the feasibility of using water from the Sudbury River to supplement the reservoir yield. However, although the Sudbury River water appears to be suitable as a water supply source (with subsequent treatment), the designation of an Ashland hazardous waste site as a U.S. EPA Superfund site might affect the MDC's decision.

In 1985, the extent of mercury, chromium and lead in sediment and fish (pickerel, brown bullhead, white perch and black crappie) were investigated. Edible fillets from five fish at each of six different locations along the river were analyzed. Mercury was the only metal detected in significant quantities, and 9 fish had mercury concentrations at or above the FDA standard of 1.0 ppm. The highest concentration was 5.2 ppm in a pickerel, in the reservoir below the hazardous waste site. Again, other metals were not detected in significant quantities. Five sediment samples were taken from the same locations and mercury as high as 76 ppm was detected in sediment samples from the station near the hazardous waste site. In 1986 water quality parameters including metals, PCB's, and volatile organics will be analyzed in water and sediment samples to determine the suitability of the Sudbury Reservoirs as a water supply source.

Secondary contact recreation is quite popular on the Sudbury and Concord Rivers. The Great Meadows National Wildlife Refuge is a large flood-plain in which the rivers languidly flow, making it ideal for canoeing and bird-watching. The Sudbury River in Hopkinton and Ashland is stocked with trout by the Massachusetts Division of Fisheries and Wildlife.

Upgrading the Concord and Billerica WWTP's will improve water quality below the respective discharges. These improvements, along with the elimination of the Lowell CSO's, will have a significant impact on improving water quality. Septic system rehabilitation/maintenance and runoff control might be necessary in some areas to achieve class B standards.

A major tributary to the Sudbury River is Hop Brook. Hop Brook is severely impacted at its headwaters by nutrients from the Marlborough-Easterly WWTP, despite the fact that the WWTP is well operated and practices both nitrification and phosphorus removal. Unfortunately a series of impoundments allows for the accumulation of these nutrients in the water column and in sediments. Extremely dense algal populations coupled with extreme diurnal dissolved oxygen swings results in significant water quality violations, which limits use of Hop Brook for recreation and/or water supply.

Diversion of the WWTP discharge from Hop Brook is a possible solution but a costly one. A long term result of diversion would be increased recreational fishing in the impoundments and improved aesthetics. The time for the impoundments to recover after diversion of the discharge has not been determined.

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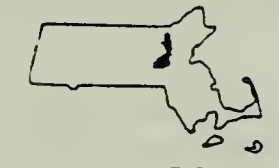
Figure 30

CONCORD AND SUDBURY RIVER BASINS (82a)



BASINS LOCATION

LEGEND

- Full Support
- Partial Support
- Non-Support
- Basin Boundary

TABLE 40
SUDBURY AND CONCORD RIVER BASINS

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Sudbury River						
Headwaters in Westborough to inlet to Reservoir No. 2, Ashland	32.7-23.2	B	S	--	--	--
Inlet to Reservoir No. 2, Ashland to Saxonville Pond, Framingham	23.2-16.2	B	NS	Metals including mercury in sediment.	Hazardous waste site.	Clean up hazardous waste site, dredge channel.
Saxonville Pond outlet to confluence with Assabet River, Concord	16.2-0.0	B	S	Dissolved oxygen.	Natural conditions.	--
Hop Brook						
Marlborough WWTP discharge to the confluence with the Sudbury River, Wayland	9.7-0.0	B	NS	Dissolved oxygen. Nutrients.	WWTP dominates flow.	Diversion of WWTP discharge to Sudbury River, dredging of impoundments has been proposed.
Concord River						
Confluence of the Assabet and Sudbury Rivers to the Billerica WWTP outfall, Billerica	15.4-6.1	B	S	--	--	--

TABLE 40 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Concord River from Billerica WWTP outfall to confluence with Merrimack River, Lowell	6.1-0.0	B	PS	Coliform bacteria.	Urban runoff.	CSO were eliminated, water quality will improve.

Miles Assessed: 57.8 mi
Miles Supporting Classification: 35.0 mi
Miles Partially Supporting Classification: 6.1 mi

TAUNTON RIVER BASIN (62)

Description of the Watershed

The Taunton River Basin is located in southeastern Massachusetts, with its extensive network of tributaries draining an area of 530 square miles. The Taunton River is formed at the confluence of the Matfield and Town Rivers in Bridgewater. The river is 40 miles in length and flows in a southerly direction to Mount Hope Bay, a sub-basin of the Narragansett Bay watershed. The Taunton River has an extremely flat gradient, ranging from 20 feet at its origin, to sea level at the estuary. The low slope causes extensive amounts of wetland areas that are characteristic of the drainage basin. The river is fairly uniform in width in its freshwater portion and then broadens into an estuary. Salt water intrusion occurs upstream to river mile 12 and tidal influence occurs upstream to river mile 18.

The watershed has a myriad of tributaries and sub-tributary systems that contribute to the flow of the main stem of the Taunton River. At the headwaters of the basin, the Salisbury Plain and Sutucket Rivers are the main contributors to the Matfield River while Coweeset and Queset Brooks are tributaries to the Town River. This portion of the basin is referred to as the Upper Taunton River Section. In the eastern portion or Lower Taunton River Section, the Winnetuxet, Nemasket and Assonet Rivers are the major sources of flow to the river, while the Mill, Three Mile and Segreganset Rivers are the major drainage areas in the western portion of the basin, often referred to as the Rumford/Three Mile Section.

The United States Geological Survey (USGS) presently operates four stream gages in the river basin. The USGS formerly maintained a stream gage on the Taunton River in Bridgewater. This gage was discontinued in 1976, measured flow from an area of 260 square miles or 49 percent of the entire Taunton River Basin. The average annual discharge for the 46 years of record was 464 cubic feet per second.

The average discharge and drainage area for the remaining four stream gages are: Wading River (two gages) - 32.7 cfs, 19.2 mi^2, and 73.3 cfs, 42.4 mi^2; Threemile River - 173 cfs, 83.3 mi^2; and Segreganset River - 22.3 cfs, 10.6 mi^2.

Water Quality Conditions and Trends

The waters of the Taunton River Basin have been historically subjected to significant inputs of wastewater discharges and, consequently, have demonstrated serious water quality problems. Currently there are 23 major industrial and municipal wastewater dischargers that have NPDES (National Pollutant Discharge Elimination System) permits in the Taunton River Basin. Seven of these are municipal wastewater treatment facilities or publicly owned treatment works (POTW's) located in Bridgewater, Brockton, Taunton, Mansfield, Fall River, Somerset, and Middleborough. Over the past ten years pollution abatement projects have been completed, and these municipal facilities were upgraded and expanded. Also, industrial discharges received treatment or have tied into POTW's with pretreatment, and some discharges have been eliminated completely, i.e., gone out of business. A current pollution abatement project is the construction of lateral sewers and interceptors to alleviate water quality

problems stemming from failing subsurface disposal systems. The three main sections within the Taunton River Basin each receive wastewater discharges and have water quality problems associated with these discharges. In the upper portion of the basin, the Town and Matfield Rivers receive discharges from Brockton and Bridgewater wastewater treatment plants. These rivers have historically been subjected to severe oxygen depletion, periodic bacterial contamination, heavy metal inputs and accelerated eutrophication. Upgrading and expanding of the Brockton WWTP to advanced wastewater treatment will improve water quality conditions in both the Matfield and Salisbury Rivers.

An ongoing pollution abatement project in the Upper Taunton River section includes the town of Whitman's construction of an interceptor and lateral sewer tie in to the Brockton WWTP. Upon completion in late 1987, water quality problems from failing septic systems will be eliminated in the areas of the Shumatusocacant River and Meadow Brook. The Bridgewater WWTP will be upgraded to advanced wastewater treatment, with completion projected for 1989.

The lower portion of the basin receives discharges within the city of Taunton. This includes numerous industrial discharges, primarily plating operations, and the Taunton WWTP discharge to the Taunton River. In 1978 the Taunton WWTP was upgraded to an 8.4 MGD pure oxygen, activated sludge, advanced wastewater treatment system. Some industrial discharges have been eliminated by being tied into the Taunton WWTP with pretreatment. Survey data in 1981 showed significant improvement in dissolved oxygen levels downstream due to the combined effect of reduction in organic loadings and the nitrification process at the Taunton WWTP. Significant improvement in water quality was also recorded for the Nemasket River. This can be attributed to upgrading the Middleborough WWTP to advanced treatment, which produces an effluent with an extremely low oxygen demand.

The third area of the Taunton River Basin is the Rumford/Three Mile section. The Mansfield WWTP, up until this past summer (1985), discharged to Back Bay Brook, a tributary to the Norton Reservoir. This discharge created severe water quality problems and added nutrients to the reservoir, which accelerated its eutrophication. During the summer of 1985, the Mansfield WWTP discharge was relocated to the Three Mile River below Norton Reservoir. This facility provides for advanced wastewater treatment. River sampling programs will be conducted in the future to document improvements in water quality within this area.

The expansion of the Mansfield WWTP provided for flows from Foxborough within the Robinson Brook area. This abatement project is presently in Step III, or the construction phase. The completed interceptor and lateral sewers will eliminate Foxborough's discharge to Robinson Brook.

In summary, the water quality of the Taunton River and its tributaries, which was poor for decades, has been improved significantly in the past decade.

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Figure 31 TAUNTON RIVER BASIN (62)

TABLE 41
TAUNTON RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Taunton River						
Taunton River from the confluence of the Town and Matfield Rivers to Route 24 bridge, Taunton	40.8-21.2	B	PS	Dissolved oxygen. Coliform bacteria.	Urban runoff. Brockton WWTP. Bridgewater WWTP.	Brockton WWTP upgraded plant. Bridgewater WWTP upgraded.
Route 24 bridge, Taunton to the Berkley Bridge, Dighton	21.2-13.0	SB	PS	Dissolved oxygen.	Upstream sources.	Upstream control measures will reduce problems.
Berkley Bridge, Dighton to Fall River city line	13.0-7.5	SB	S	--	--	--
Fall River city line to the mouth in Mount Hope Bay, Fall River	7.5-0.0	SB	PS	Coliform bacteria.	CSO's.	CSO control needed.
Plain River						
Matfield-Salisbury Rivers from Prospect Street, Brockton to confluence with the Town River, Bridgewater	53.3-40.8	B	NS	Dissolved oxygen. Coliform bacteria.	Historical problems with Brockton WWTP. Urban runoff.	Runoff control. Brockton WWTP was upgraded in 1985.
Trout Brook from Route 28, Avon to confluence with the Salisbury Plain River, Brockton	4.0-0.0	B	PS	Dissolved oxygen. Coliform bacteria.	Nutrients causing eutrophication.	Possibly urban runoff control; source of problem not clearly defined.

TABLE 41 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Beaver Brook from Groveland St. to confluence with the Salisbury Plain River, East Bridgewater	5.5-0.0	B	PS	Dissolved oxygen. Coliform bacteria.	Wetlands. Stormwater.	Undefined, nonpoint source pollutant control.
Satucket-Shumatusacacant Rivers from Central St., Abington to confluence with the Matfield River, East Bridgewater	14.4-0.0	B	PS	Dissolved oxygen. Coliform bacteria.	Septic systems. Wetlands.	Sewer construction is being conducted in Whitman
Town - Hockomock Rivers from the confluence of Queset and Coweeset Brooks, West Bridgewater to confluence with the Matfield River, Bridgewater	11.7-0.0	B	PS	Dissolved oxygen.	Wetlands. Eutrophication. Bridgewater WWTP.	Vast areas of wetlands causes naturally low dissolved oxygen. Bridgewater WWTP is being upgraded.
Robinson Brook from Cocasset Street, Foxborough to confluence with Rumford River, Foxborough	3.0-0.0	B	PS	Dissolved oxygen. Nutrients. Coliform bacteria.	Wetlands. Foxborough Co. discharge.	Tie in Foxboro Co. to Mansfield WWTP.
Rumford/Threemile Rivers from headwaters to confluence with Taunton River, Dighton	18.4-0.0	B	PS	Dissolved oxygen. Coliform bacteria.	CSO's in Dighton.	CSO abatement.

TABLE 41 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Wading River from Spruce Street, Foxborough to confluence with Threemile River, Norton	11.3-0.0	B	S	--	--	--
Segreganset River from Center St., Dighton to confluence with the Taunton River, Freetown.	2.5-0.0	B	PS	Dissolved oxygen. Coliform bacteria.	Unknown.	Further quantification of problem is required.
Assonet River from Route 74, Freetown to confluence with Taunton River, Freetown	6.0-0.0	B	S	Dissolved oxygen.	Natural wetlands.	--
Queset Brook from outlet of Longwater Pond, Easton to confluence with Coweeset Brook, West Bridgewater	2.8-0.0	B	S	--	--	--
Coweeset Brook from Pearl Street, Brockton to confluence with Queset Brook, West Bridgewater	3.6-0.0	B	S	--	--	--

TABLE 41 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Winnetuxet River from Route 58 to confluence with Taunton River, Halifax	6.7-0.0	B	PS	Dissolved oxygen. Coliform bacteria.	Wetlands cropland drainage.	Natural conditions. Proper control of fertilizer needed.
Nemasket River from Vaughan Street, Middleborough to confluence with the Taunton River, Middleborough	10.5-0.0	B	S	--	--	--
Canoe Snake Rivers from Cocasset Street, Foxborough to outlet of Lake Sabbatia, Taunton	18.2-3.1	B	S	--	--	--
Mill River from outlet of Lake Sabbatia, Taunton to confluence with Taunton River, Taunton	3.1-0.0	B	PS	Dissolved oxygen. Coliform bacteria.	CSO's in Taunton.	Control and/or elimination of CSO's.

Miles Assessed: 171.9 mi
Miles Supporting Classification: 56.0 mi
Miles Partially Supporting Classification: 84.6 mi

TEN MILE RIVER BASIN (52)

Description of the Watershed

The Ten Mile River drains an area of 54 square miles in southeastern Massachusetts and eastern Rhode Island. Originating in Savage's Pond in Plainville, Massachusetts, the river flows generally south to southwest through the Massachusetts communities of Plainville, North Attleborough, Attleboro, and Seekonk to Pawtucket and East Providence, Rhode Island, where the Ten Mile River empties into the Seekonk River and ultimately into the Narragansett Bay estuary. The total length of the Ten Mile River is 22 miles, of which 15 miles are in Massachusetts. The elevation of the river drops from 230 feet above mean sea level at its source to ten feet at its confluence with the Seekonk River. River flow is characterized, and controlled, by 15 dams that create eutrophic impoundments.

The two major tributaries to the Ten Mile River are the Bungay and Seven Mile Rivers. The former originates in a wetland in the town of North Attleborough and flows southerly through an extensive wetland system, for approximately five miles, joining the Ten Mile River just upstream of Mechanics Pond in the city of Attleboro. The drainage area for the Bungay River system is less than eight square miles. The Seven Mile River system begins in the town of North Attleborough and flows in a southerly direction through a series of ponds and reservoirs which are controlled for the city of Attleboro's water supply system. The drainage area for this system is 12.7 square miles. The Bungay and Seven Mile Rivers are considered by the DWPC as natural, or "clean-water." They are not pristine since they are affected by non-point sources typically found in Massachusetts rivers, but they are also not impacted by point source discharges of pollutants. Their water quality is used as a bench mark for the evaluation of the Ten Mile River.

The physical characteristics of the basin are dominated by low, gently rolling hills with elevations ranging from near sea level at the mouth to over 400 feet above sea level in the northern portion of the basin. Urban development in the basin is centered in the communities of Plainville, North Attleborough, Attleboro, Pawtucket, and East Providence with the development along most of the areas adjacent to the Ten Mile River. Recent development in the basin has reflected the growth patterns in eastern Massachusetts and has brought increased pressure upon the natural resources of the basin.

The Ten Mile River Basin has a temperate climate typical of coastal New England. Its average annual temperature is 50°F, with February being the coldest month with a mean temperature of 29°F and July being the warmest with a mean temperature of 72°F. Precipitation is generally well distributed throughout the year, averaging 44 inches annually.

Water Quality Conditions and Trends

For two centuries the Ten Mile River Basin has been a center of industrial development, particularly in the jewelry manufacturing field. In 1780, the first jewelry shop was opened and in 1807 the first manufacturing plant was built. In addition, textiles and tanneries were prevalent in the basin. The first tannery opened in 1787. The industrial nature of the river basin engendered waste disposal and water quality problems.

In 1964, none of the industrial wastewater discharges received any treatment and the two major municipal areas provided some treatment of their domestic wastewaters. In 1968, there were 65 known discharges to the Ten Mile River and its tributaries, 57 of these discharges received no treatment. By 1973, through an intensive program governed by the U.S. EPA and the Division of Water Pollution Control and with significant cooperation from the industries, the wastewater disposal problems in the basin were being reduced through an intensive abatement program. Some discharges were pre-treated and conveyed to the municipal wastewater treatment plants. There were 40 discharges to the river, each of which received treatment. This was a remarkable turn around in such a short period of time.

The two municipal wastewater discharges to the river, North Attleborough and Attleboro, had historically caused water quality problems. Aging sewerage systems and untreated industrial influents complicated the problems of proper operation of the existing facilities. However, in 1980, both facilities were upgraded to advanced wastewater treatment, thus significantly reducing the loadings to the stream and lessening the resultant water quality problems. With proper pre-treatment regulations and enforcement, these facilities will produce a high quality effluent.

During the period when the industrial discharges were untreated, heavy metals, acids and various organic compounds were discharged to the river, which created a toxic environment. This limited the biota and rendered the Ten Mile as little more than a conveyor of sewage. With implementation of treatment of the industrial discharges the toxic nature of the river was reduced, but not removed. In addition, organic loadings continued to deplete dissolved oxygen levels; wastewaters continued to provide nutrients necessary for excessive algal growth; and improper disinfection caused bacterial contamination. The upgrading of the municipal wastewater treatment facilities and other abatement projects improved water quality, but did not eliminate all problems.

The Ten Mile River has a small watershed and is subject to low flow conditions during summer drought conditions. The stream is impounded at 15 locations which creates ideal conditions for eutrophication and provides a sink for sedimentation. The sediments have high concentrations of heavy metals. Effects of the metals upon stream biota was the focus of an intensive survey in 1985. Significant toxicity was determined as a consequence of this survey. In addition, the river is an urban river and hence is subject to runoff and the associated problems of oil and grease, silt and bacteria. These problems need to be addressed in more detail after the implementation of enhanced metals removal at all discharges.

The future water use of the Ten Mile River will be limited by its hydraulic restraints but improved metals removal at wastewater discharges will improve water quality, and water uses.

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Figure 32 TEN MILE RIVER BASIN (52)

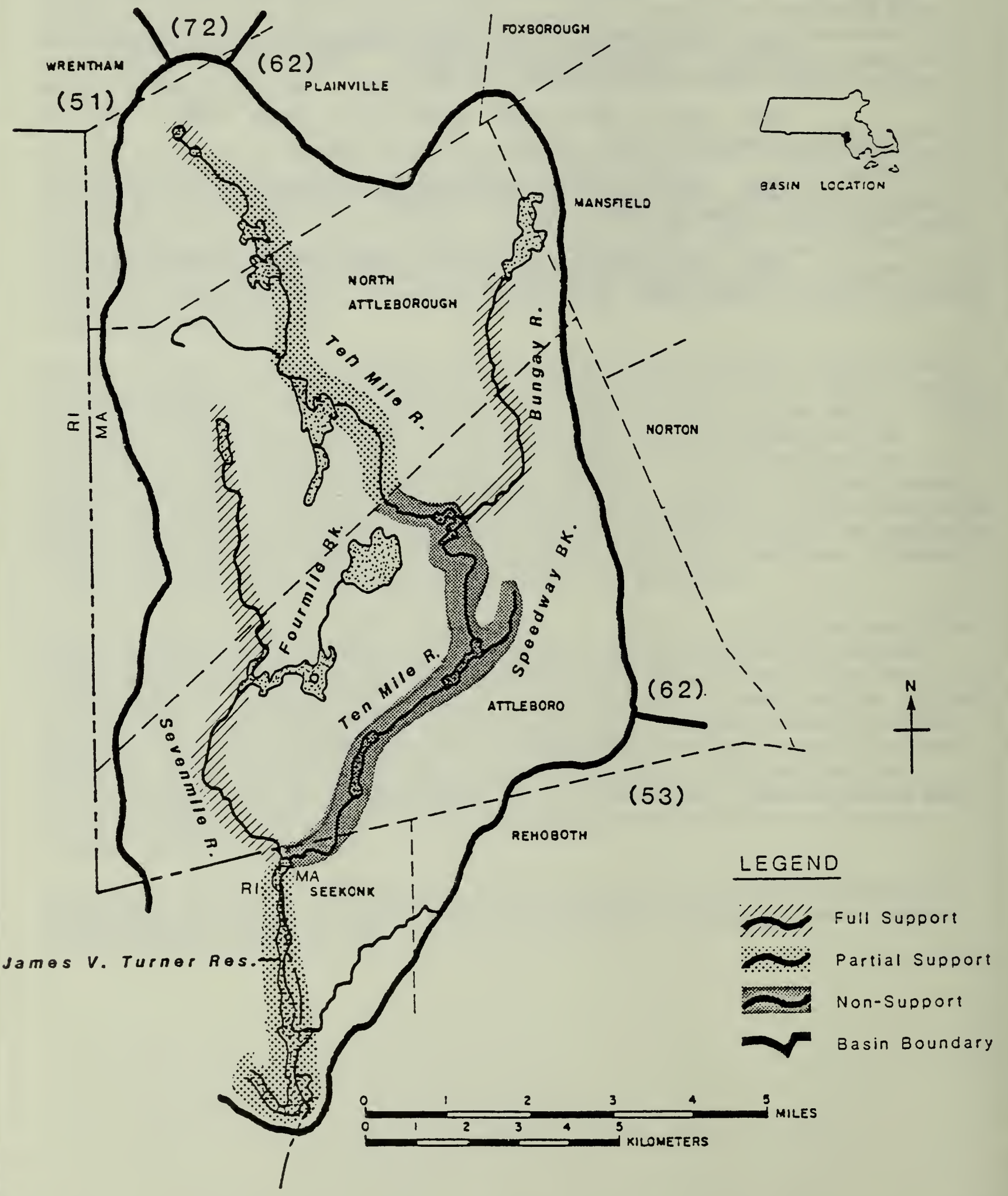

TABLE 42
TEN MILE RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Ten Mile River						
Headwaters in Plainville to inlet W. Bacon Street, Plainville	20.7-19.8	B	S	--	--	--
W. Bacon Street, Plainville to N. Attleborough WWTP, Attleboro	19.8-15.5	B	PS	Coliform bacteria. Eutrophication. Toxicity.	Urban runoff. Industrial discharges. In-place sediments.	Non-point sediment control. Increased treatment.
N. Attleborough WWTP to Attleboro WWTP, Seekonk	15.5-7.6	B	NS	Coliform bacteria. Dissolved oxygen. Eutrophication. Toxicity.	Urban runoff. Industrial and municipal discharges. In-place sediments.	Non-point sediment control. Increased treatment.
Attleborough WWTP to confluence with Seekonk River, East Providence, R.I.	7.6-0.0	B	PS	Eutrophication. Toxicity.	Urban runoff. Industrial and municipal discharges. In-place sediments.	Non-point sediment control. Increased treatment.
Speedway Brook						
Headwaters to confluence with Ten Mile River, Attleboro	0.9-0.0	B	NS	Coliform bacteria. Dissolved oxygen. Aesthetics. Toxicity.	Untreated sewage discharge. Urban runoff. Industrial discharge.	Elimination of untreated discharge. Non-point control. Increased treatment.

TABLE 42 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Bungay River						
Headwaters to confluence with Ten Mile River, Attleboro	4.0-0.0	B	S	Dissolved oxygen.	Natural wetland influence.	--
Seven Mile River						
Headwaters to Orrs Pond outlet, Attleboro	6.0-3.0	A	S	--	--	--
Orrs Pond to confluence with Ten Mile River, Attleboro	3.0-0.0	B	S	--	--	--

Miles Assessed: 31.6 mi
Miles Supporting Classification: 10.9 mi
Miles Partially Supporting Classification: 11.9 mi

WESTFIELD RIVER BASIN (32)

Description of the Watershed

The Westfield River Basin covers 517 square miles of west-central Massachusetts and includes portions of Franklin, Hampden, and Berkshire counties. Sparsely populated in the upper reaches, the basin's population is concentrated in the southeastern corner in the municipalities of Agawam, Holyoke, Westfield, and West Springfield.

The Westfield River begins in Savoy at a point over 2,000 feet above mean sea level. Flowing southeast, with ridges rising 500 to 900 feet above the adjacent valleys, the river remains mostly in its natural state, surrounded by second and third-growth forest cover. Dropping 1,000 feet in the first 14 miles, the river swiftly makes its way to Huntington where it is joined by the middle and west branches.

The Middle Branch of the Westfield River begins in the town of Peru and flows 18 miles to join the main branch 27 miles above its mouth. Falling 1,250 feet along its course, the Middle Branch has a drainage area of 52.6 square miles and an average flow of 102 cfs at the United States Geological Survey gage just above its confluence with the main branch.

In Becket, the West Branch of the Westfield River is formed by the confluence of Depot and Yokum Brooks. This branch flows 17.5 miles through Becket, Middlefield and Chester, falling 840 feet before joining the Main Branch in Huntington 25 miles above its mouth. At the United States Geological Survey gage 1.5 miles upstream of its confluence, the West Branch has an average flow of 182 cfs and drains an area of 93.7 square miles.

Below Huntington the river flows over three dams in succession and the river slope decreases as it approaches the town of Westfield. The Westfield River is joined by the Little River 11 miles above its mouth, just as the river is reaching the floodplain of the Connecticut River. The river deepens and winds its way through Robinson State Park and over one more dam in West Springfield before it joins the Connecticut River. The average flow of the Westfield at its confluence with the Connecticut River is 930 cfs.

Water Quality Conditions and Trends

The waters of the upper portion of the Westfield River Basin, the east, west, and middle branches, remain unpolluted. This watershed is sparsely populated and has little industry. The water quality of the main stem Westfield River remains quite good from the confluence of the three branches down to the Strathmore Company Dam in Woronoco. This segment had frequent bacteria violations in past years due to raw sewage discharges to the river. However, pollution abatement projects in Huntington and Russell have eliminated this problem.

The Westfield River below the dam at Woronoco to the confluence with the Little River has elevated bacteria concentrations. These are caused by raw discharges from the village of Woronoco. These homes should be tied into the Russell WWTP. This river segment also receives a high solids and organic load from the Strathmore Paper Company discharge.

The Westfield River, from the confluence of the Little River to its confluence with the Connecticut River, receives a much higher pollutant load than its upstream segments. Many of these pollutants sources are related to the urban watershed. The area has an old sewer system which operates poorly. Urban runoff from this portion of the watershed degrades the water quality of the river. The Westfield WWTP experiences operational problems during wet weather which cause additional water quality problems.

There are two abatement projects in progress which will improve the water quality of the lower portion of the Westfield River. A sewer rehabilitation program for portions of the city of Westfield is in the construction phase. Abatement strategies for CSO's to the Westfield River from the town of Agawam will be developed in a CSO project for the Lower Connecticut River Basin.

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Figure 33 WESTFIELD RIVER BASIN (32)

TABLE 43
WESTFIELD RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
West Branch Westfield River						
Source in Becket to confluence with main stem Westfield River, Huntington	17.5-0.0	B	S	--	--	--
Middle Branch Westfield River						
Source in Peru to Littleville Dam, Huntington	18.1-1.0	A	S	--	--	--
Littleville Dam to confluence with main stem Westfield River, Huntington	1.0-0.0	B	S	--	--	--
Mainstem Westfield River						
Source in Savoy to confluence with West Branch, Huntington	62.5-25.1	B	S	--	--	--
From confluence with West Branch to Mass. Pike Bridge, Westfield	25.1-17.3	B	S	--	--	--

TABLE 43 (CONTINUED)

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
From Mass. Pike Bridge to confluence with Connecticut River, West Springfield-Agawam	17.3-0.0	B	PS	Coliform bacteria.	Stormwater runoff. Isolated domestic discharges.	Stormwater runoff management. Sewer extension and renabilitation.
Little River						
From Horton's Bridge to confluence with Westfield River, Westfield	4.7-0.0	B	PS	Coliform bacteria.	Dry weather sewer discharges. Urban runoff.	Sewer system rehabilitation.
Powdermill Brook						
from confluence with Arm Brook to confluence with Westfield River, Westfield	3.2-0.0	B	S	--	--	--

Miles Assessed: 106.0 mi
Miles Supporting Classification: 84.0 mi
Miles Partially Supporting Classification: 22.0 mi

THE WEYMOUTH AND WEIR RIVER BASIN (74)

Description of the Watershed

The Weymouth Fore River drains portions of the communities of Holbrook, Avon, Brockton, Randolph, Milton, Quincy, Braintree, and Weymouth. The river is approximately 12 miles in length. The headwaters are referred to as the Cochato River, the middle portion is called the Monatiquot River, and the lower tidal portion is known as the Weymouth Fore River. The river discharges into Hingham Bay. The area drained by the Weymouth Fore is 42.25 square miles.

The Weymouth Back River drains an area of 26.5 square miles and includes portions of the towns of Weymouth, Hingham, Holbrook, Braintree, and Rockland. Two tributaries form the headwaters of the Weymouth Back River.

Water Quality Conditions and Trends

The limited data available for the Weymouth and Weir Rivers Basins indicate coliform violations. These violations occur largely from urban runoff and onsite septic system failures. A summary of municipal wastewater facilities in the Weymouth and Weir River Basins follows. This survey covers ongoing projects in the towns of Hingham, Braintree, Weymouth and Quincy.

Braintree: The town of Braintree is 99% sewered to the Nut Island POTW and it plans to sewer the areas of potential on-site disposal problems. The town completed an inflow/infiltration (I/I) analysis, which indicated 6.7 mgd of peak infiltration and 0.13 mgd of peak inflow, of which 0.56 mgd and 0.009 mgd, respectively, is considered excessive. On April 23, 1984 a phase I Sewer System Evaluation Survey (SSES) was funded by DWPC. It included a physical survey and flow isolator program, including smoke testing and house to house inspection to verify the inflow volumes.

Hingham: Seventy-seven percent of the population is sewered to the Metropolitan Sewage District with treatment at the Nut Island POTW. The remainder of the town is served by on-lot wastewater disposal systems. The Hingham sewer system discharges to the MWRA Hingham pump station at Stodders neck.

On-lot subsurface disposal systems periodically discharge to storm drainage systems, inland brooks or the ocean. The Eastern Massachusetts Metropolitan Area (EMMA) study recommended the reconstruction of the Hingham pump station and force main. Reconstruction project is presently being funded under a DWPC construction grant. The I/I cost-effective analysis in the facility plan recommended that it was cost-effective to remove 4.86 mgd of the total peak inflow of 5.50 mgd. A state planning advance for a physical survey and flow isolation program was awarded on July 1, 1984, but the town changed consultants, which delayed the project start.

Quincy: The city is sewered to the Nut Island POTW. The Braintree-Weymouth Extension Sewer conveys wastewater from the communities of Braintree, Weymouth and Hingham as well as portions of Quincy to the Nut Island facility. Various segments of the Quincy collection system experience backups and overflows, which cause transient water quality problems and nuisance conditions that impact the Town River, Town River Bay and Furnace Brook. The city was awarded a grant in 1983 for an emergency lift station on the Furnace Brook interceptor, rehabilitation of the Town River Bay interceptor, relief of the North Quincy and Furnace Brook interceptors, rehabilitation of the Quincy Point pumping station, and diversion/relief of the sewer area served by the Quincy Point pumping

station. The I/I analysis of the city found 7.1 mgd of infiltration and 0.9 mgd of inflow, of which 3.0 mgd and 0.6 mgd, respectively, were considered excessive. The city has received a state grant to do the SSES.

Weymouth: Seventy percent of the town is sewered and Weymouth plans to sewer the entire population. Sewage is discharged through 16 connections in the MSD for treatment at the Nut Island POTW. There are persistent on-lot disposal system problems. The proposed project includes 12,400 feet of lateral sewers, 535 feet of force mains, and one ejector station. The EMMA study estimated 5.10 mgd infiltration and 3.00 mgd inflow. On March 5, 1984 a state planning advance was awarded to the town to perform I/I analysis and prepare a facilities plan.

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Figure 34 WEYMOUTH AND WEIR RIVER BASIN (74)

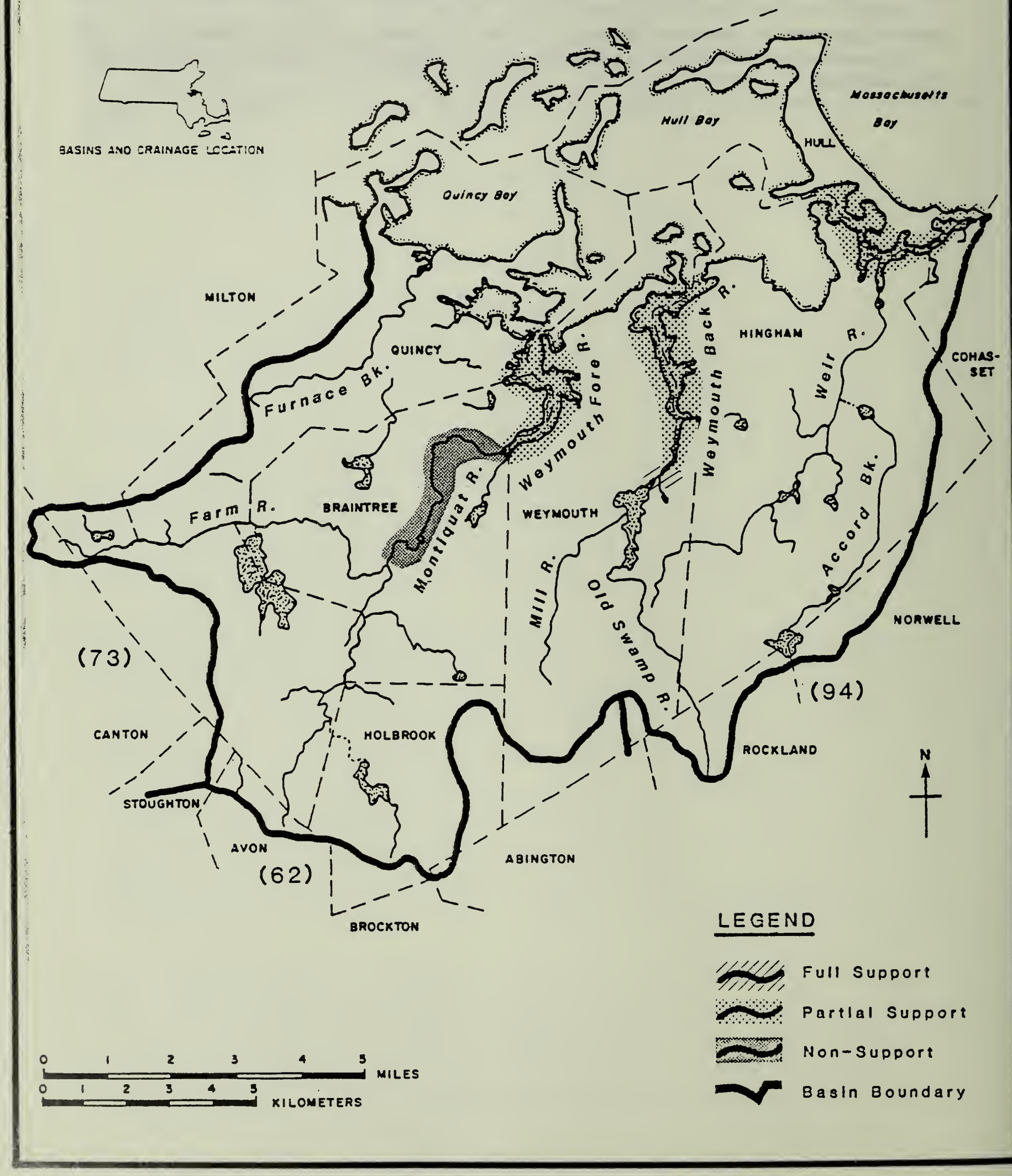

TABLE 44
WEYMOUTH AND WEIR RIVER BASIN

SEGMENT DESCRIPTION	RIVER MILES	WATER USE CLASSIFICATION	SUPPORT USE	WATER QUALITY PROBLEMS	SOURCE(S) OF PROBLEMS	ABATEMENT NEEDS TO MEET CLASSIFICATION
Monatiquot River from source to Weymouth Fore River, Braintree	8.3-5.1	B	NS	Dissolved oxygen. Coliform.	Urban runoff. Septic system failure.	Sewer extensions to Metropolitan Sewerage District in progress.
Weymouth Fore River from Monatiquot River to Hingham Bay, Weymouth-Quincy	5.1-0.0	SB	PS	Coliform.	Urban runoff. Septic system failure.	Sewer extensions to Metropolitan Sewerage District in progress.
Weymouth Back River from Whitmans Pond to Fresh River, Weymouth	4.5-3.2	B	S	--	--	--
Weymouth Back River from the Fresh River to Hingham Bay, Weymouth-Hingham	3.2-0.0	SB	PS	Coliform.	Urban runoff. Septic system failure.	Sewer extensions to Metropolitan Sewerage District in progress.
Weir River from outlet Straits Pond in Hingham to Hingham Bay	0.9-0.0	SB	PS	Dissolved oxygen.	CSO.	CSO treatment or separation.

Miles Assessed: 13.7 mi
Miles Supporting Classification: 1.3 mi
Miles Partially Supporting Classification: 9.2 mi

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